Release Note

Software Version 2.9.1

For AT-8800, Rapier i, AT-8700XL, AT-8600, AT-9900, x900-48FE, AT-8900 and AT-9800 Series Switches, and AR400 and AR700 Series Routers

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Introduction

Allied Telesis announces the release of Software Version 2.9.1 on the products in the following table. This Release Note describes the new features and enhancements.

Product series	Models
x900-48FE	x900-48FE, x900-48FE-N
AT-9900	AT-9924T, AT-9924SP, AT-9924T/4SP
AT-8900	AT-8948
AT-9800	AT-9812T, AT-9816GB
Rapier i	Rapier 24i, Rapier 48i, Rapier 16fi
AT-8800	AT-8824, AT-8848
AT-8700XL	AT-8724XL, AT-8748XL
AT-8600	AT-8624T/2M, AT-8624POE, AT-8648T/2SP
AR700	AR725, AR745, AR750S, AR750S-DP, AR770S
AR400	AR415S, AR440S, AR441S, AR442S, AR450S

The product series that each feature and enhancement applies to are shown in "Overview of New Features" on page 7. This Release Note should be read in conjunction with the Installation and Safety Guide or Quick Install Guide, Hardware Reference, and Software Reference for your router or switch. These documents can be found on the Documentation and Tools CD-ROM packaged with your router or switch, or:

www.alliedtelesis.com/support/software

This Release Note has the following structure:

1. **Upgrading to Software Version 2.9.1**

   This section lists the names of the files that may be downloaded from the web site.

2. **Overview of New Features**

   This section lists the new features and shows the product families on which each feature is supported.

3. **Descriptions of New Features**

   These sections describe how to configure each new feature.

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Upgrading to Software Version 2.9.1

Software Version 2.9.1 is available as a flash release that can be downloaded directly from the Software/Documentation area of the Allied Telesis website:

www.alliedtelesis.com/support/software

For information about licencing this release, see "Release Licences" on page 5.

The following table lists the file names for Software Version 2.9.1.

Product name	Release file	GUI resource file	CLI help file
AT-9924T	89-291.rez	9924_291-00_en_d.rsc	9-291321.hlp
AT-9924SP	89-291.rez	9924_291-00_en_d.rsc	9-291321.hlp
AT-9924T/4SP	89-291.rez	9924_291-00_en_d.rsc	9-291321.hlp
AT-8948	89-291.rez	—	9-291321.hlp
x900-48FE	89-291.rez	—	9-291321.hlp
x900-48FE-N	89-291.rez	—	9-291321.hlp
AT-9812T	sb-291.rez	9812_291-00_en_d.rsc	98-291a.hlp
AT-9816GB	sb-291.rez	9816_291-00_en_d.rsc	98-291a.hlp
Rapier16fi	86s-291.rez	r16i_291-00_en_d.rsc	rp-291a.hlp
Rapier 24i	86s-291.rez	r24i_291-00_en_d.rsc	rp-291a.hlp
Rapier 48i	86s-291.rez	r48i_291-00_en_d.rsc	rp-291a.hlp
AT-8824	86s-291.rez	8824_291-00_en_d.rsc	88-291a.hlp
AT-8848	86s-291.rez	8848_291-00_en_d.rsc	88-291a.hlp
AT-8724XL	87-291.rez	8724_291-00_en_d.rsc	87-291a.hlp
AT-8748XL	87-291.rez	8748_291-00_en_d.rsc	87-291a.hlp
AT-8624POE	sr-291.rez	8624poe_291-00_en_d.rsc	86-291a.hlp
AT-8624T/2M	sr-291.rez	8624t_291-00_en_d.rsc	86-291a.hlp
AT-8648T/2SP	sr-291.rez	8648t_291-00_en_d.rsc	86-291a.hlp
AR770S	55-291.rez	—	700-291a.hlp
AR750S-DP	55-291.rez	750s_291-00_en_d.rsc	700-291a.hlp
AR750S	55-291.rez	750s_291-00_en_d.rsc	700-291a.hlp
AR725	52-291.rez	725_291-00_en_d.rsc	700-291a.hlp
AR745	52-291.rez	745_291-00_en_d.rsc	700-291a.hlp
AR440S	54-291.rez	440s_291-00_en_d.rsc	400-291a.hlp
AR441S	54-291.rez	441s_291-00_en_d.rsc	400-291a.hlp
AR442S	54-291.rez	442s_291-00_en_d.rsc	400-291a.hlp
AR415S	54-291.rez	415s_291-00_en_d.rsc	400-291a.hlp
AR450S	54-291.rez	450s_291-00_en_d.rsc	400-291a.hlp

Release Licences

Release licences are valid for all releases for switches and routers manufactured at the end of 2006. This means you can upgrade on these devices without entering the **enable release** command.

If you already have a device, contact your Allied Telesis representative for information about licencing. If you are not sure whether your device licence is valid for all releases, use the following command:

```
show release
```

If your router or switch does not have the following output, contact your Allied Telesis representative to request a licence.

```
 Release                 Licence              Period
-----------------------------------------------------
 any                     full                 -
-----------------------------------------------------
```

A new release licence is not required when you are updating to a minor or maintenance release. This change affects release licences only, and not special feature licences.

Upgrading the GUI File

The naming convention for GUI resource files changed from Software Version 2.8.1 onwards. Names are now longer, and they include more information about the router or switch model and software version to which the file applies. For example, the GUI resource file for AT-9924 Series switches for Software Version 291-01 is 9924_291-01_en_d.rsc.

Software versions before 2.8.1 do not recognise the new GUI name format. This changes the upgrade process slightly.

Previous process

With earlier software versions, you could upgrade the release file and the GUI file at the same time, by using the following steps:

1. Load each file onto the router or switch.
2. Set both files as the preferred install files, by using the command:

   `set install=pref rel=`*`new-rez-file`* `gui=`*`new-gui-file`*
3. Reboot the router or switch.

New process

The first time you upgrade to a 2.9.1 version, you need to install the release before the GUI, by using the following steps:

1. Load each file onto the router or switch.
2. Set the new release file as the preferred install file and uninstall the previous GUI file, by using the command:

   `set install=pref rel=`*`291-rez-file`* `gui=`
3. Reboot the router or switch.
4. Set the new GUI file as the preferred GUI file, by using the command:

   `set install=pref gui=`*`291-gui-file`*

   While the router or switch installs the GUI, the console is unresponsive. This may take a minute.

If you upgrade from a 2.9.1 version to a later 2.9.1 maintenance version, you can install the release and GUI in the same step.

Also, some TFTP servers do not support filenames longer that 8 characters and therefore will not allow you to load the file from the server. With such servers, you can simply rename the GUI file to a short name on the TFTP server, then rename it correctly on the router or switch.

Backwards Compatibility

If you have scripts that use the following features, you need to be aware that the behaviour has changed:

- The **group** parameter in the **add vlan port** is now mandatory when you add a trunk group to a private vlan as private ports (see **Group Parameter Required for Private VLAN Ports**).
- The **delete dhcpsnooping binding** command has a new mandatory **ip** parameter (see **Adding Default Access Routers to Static Entries**).
- The **pairmode** parameter in the **set shdsl** command has new options that replace the options **4wire** and **2pair** (see **ITU Standard Mode Operation**). When configuring an SHDSL interface to transmit data over a 4 wire connection, you must now specify whether it is a standard connection using the options **4wires** or **2pairs**, or an enhanced connection using the options, **4wiree** or **2paire**.

Overview of New Features

The following table lists the new features and enhancements by product series. For supported models, see "Introduction" on page 3.

	AR400	AR700	Rapier	AT-8800	AT-8700XL	AT-8600	AT-9800	AT-8900	x900-48FE	AT-9900
AT-8600: **GUI Support for AT-8624POE and AT-8648T/2SP**						✓				
AT-8600: **Protocol Independent Multicast (PIM) Support**						✓				
AT-8600: **AT-8624POE Fan Enhancements**						✓				
AT-8600: **Support for AT-45/xx series and AT-47 Expansion Modules**						✓				
AR400: **VPN Configuration Wizards**	✓									
System: **Activate Findme Feature**				✓						
System: **Enhanced Protection for Filenames**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
System: **Increased Module Support by Show Debug Active**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Switching: **Multiple Uplink Ports in Private VLANs**			✓	✓	✓	✓				
Switching: **Group Parameter Required for Private VLAN Ports**			✓	✓	✓	✓				
PoE: **PoE Firmware Upgrade**						✓				
SHDSL: **ITU Standard Mode Operation**	✓									
Bridging: **VLAN to WAN Bridging**	✓	✓								
Bridging: **Retaining or Stripping VLAN Tags**	✓	✓								
IP: **Dynamic DNS Client**	✓	✓								
IP: **Preventing MAC Address Resolution Between Hosts Within a Subnet**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
IP: **IP Debug Timeout**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
IP: **Show IP Interface Command Displays Gratuitous ARP Status**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
DHCP: **DHCP Options**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
DHCP snooping: **Adding Default Access Routers to Static Entries**			✓	✓	✓	✓		✓	✓	✓
DHCP snooping: **Filtering Broadcast and Multicast Packets**			✓	✓	✓	✓		✓	✓	✓
MAC-Forced Forwarding: **MAC-Forced Forwarding**			✓	✓	✓	✓		✓	✓	✓
IP multicasting: **PIM Support on AT-8600 Series Switches**						✓				
IP multicasting: **Query Solicitation**			✓	✓	✓	✓	✓	✓	✓	✓
OSPF: **Neighbour Retransmission List Debugging**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
BGP-4: **Improved BGP Route Selection**	✓	✓	✓	✓			✓	✓	✓	✓
BGP-4: **Improved BGP Backoff Show Command Output**	✓	✓	✓	✓			✓	✓	✓	✓
IPv6: **Setting a Metric for RIPv6**	✓	✓	✓	✓			✓	✓	✓	✓

	AR400	AR700	Rapier	AT-8800	AT-8700XL	AT-8600	AT-9800	AT-8900	x900-48FE	AT-9900
IPv6: **Additional Show Command Filtering**	✓	✓	✓	✓			✓	✓	✓	✓
Firewall: **Using Automatic Client Management to Manage SIP Sessions**	✓	✓	✓	✓						
Firewall: **Setting a Trigger for Automatic Client Management**	✓	✓	✓	✓						
Firewall: **Limiting Firewall Sessions from a Device**	✓	✓	✓	✓			✓			
Firewall: **Monitoring Firewall Sessions using SNMP**	✓	✓	✓	✓			✓			
Firewall: **Dynamic Renumbering of Firewall Rules**	✓	✓	✓	✓			✓			
IPsec: **Additional RFC and Draft Compliance for NAT-T**	✓	✓	✓	✓						
IPsec: **Increase to Maximum Number of IPsec SA Bundles**	✓	✓	✓	✓						
IPsec: **Improved Debugging Options for IPsec and ISAKMP**	✓	✓	✓	✓						
IPsec: **Improved Output for IPsec and ISAKMP Counters**	✓	✓	✓	✓						
IPsec: **Modified Expiry Timeout Limit for Security Associations**	✓	✓	✓	✓						
LLDP: **Link Layer Discovery Protocol**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Management Stacking: **Changes to Local Commands**			✓	✓	✓	✓		✓	✓	✓

AT-8600 Series Switch Enhancements

This Software Version includes the following enhancements for the AT-8600 Series switches:

- GUI Support for AT-8624POE and AT-8648T/2SP
- Protocol Independent Multicast (PIM) Support
- AT-8624POE Fan Enhancements
- Support for AT-45/xx series and AT-47 Expansion Modules

This section describes the enhancements.

GUI Support for AT-8624POE and AT-8648T/2SP

Software Version 2.9.1 introduces support in the GUI module to allow loading and execution of GUI resource files on AT-8624POE and AT-8648T/2SP switches.

Previously, in the AT-8600 range of switches, GUI support was available for the AT8624T/2M only. Now, all GUI pages that are available for the AT8624T/2M switch, are also available for the AT-8624POE and AT-8648T/2SP switches.

Protocol Independent Multicast (PIM) Support

This Software Version introduces Protocol Independent Multicast (PIM) on the AT-8600 Series switches. For information about configuring PIM on your switch, see the *IP Multicasting* chapter at the end of this Release Note.

When running Software Version 2.9.1 on an AT-8600 Series switch, you will need a special feature licence to use PIM. Contact your authorised Allied Telesis distributor or reseller for details and passwords of feature licences.

AT-8624POE Fan Enhancements

This Software Version includes enhanced control over the AT-8624POE switch fan speed. Previously, in a situation where mechanical problems in the fan cause the software to generate multiple alarms, this could result in the fan speed repeatedly changing. To prevent this, the fan speed is now automatically set to the maximum speed if the fan reports an error more than 3 times in any 1-hour period.

This Software Version also includes support for the new 7000RPM fan and the associated mod level of M2-2, for AT-8624POE switches.

Support for AT-45/xx series and AT-47 Expansion Modules

Previously, the AT-8600 Series switches supported the AT-A46 expansion module only. New in this Software Version is support for AT-A45/xx series and AT-A47 expansion modules on the AT-8600 Series switches.

The following shows the complete list of currently supported expansion modules:

Expansion Module	Port Type	Connector Type
AT-A45/MT	100Base-FX	MT-RJ
AT-A45/SC	100Base-FX	SC
AT-A45/SC-SM15	100Base-FX	SC
AT-A46	10/100/1000BASE-T	RJ-45
AT-A47	1000Base-T (GBIC)	GBICs are sold separately

AR400 Series Router Enhancements

This Software Version includes the following enhancement for the AR400 Series switches:

- **VPN Configuration Wizards**

This section describes the enhancement.

VPN Configuration Wizards

This enhancement makes it simple to configure VPNs on AR415S, AR440S, AR441S, and AR442S routers. The web-based GUI for these routers now includes new wizards for setting up:

- site-to-site VPNs, for secure communication between the local LAN and LANs at remote sites
- remote access VPNs, for remote user access to the local LAN through secure connections

The wizards ask you to enter a few details, from which they configure all the settings the VPN requires, including:

- Encryption to protect traffic over the VPN
- ISAKMP with a pre-shared key to manage the VPN key transfer
- the firewall, to protect the LANs and to allow traffic to use the VPN
- Network Address Translation (NAT), so that you can access the Internet from the private LAN through a single public IP address. This Internet access does not interfere with the VPN solution.
- NAT-Traversal, if necessary
- L2TP, PPP and user settings for remote access VPNs

All wizard-created VPN tunnels use the same WAN interface, and use vlan1 as the LAN interface.

The first time you use the GUI it opens on the Wizards page. After initial configuration, it may instead open on the System Status page. To access the wizards from there, click on the Wizards button in the left-hand menu.

For examples of how to use the site-to-site VPN wizard, see the following How To Notes:

- *How To Use the Allied Telesis GUI to Customise the Router and Set Up Connections*
- *How To Use the Allied Telesis GUI Wizard to Create a Site-to-Site VPN through a NAT Gateway Device*. Use this Note when both ends of your VPN are Allied Telesis routers.
- *How To Use the Allied Telesis GUI Wizard to Create a Site-to-Site VPN*. Use this Note when both ends of the VPN are Allied Telesis routers and the VPN does not go through a NAT gateway device.
- *How To Create a VPN between an Allied Telesis and a SonicWALL router, with NAT-T*
- *How To Create a VPN between an Allied Telesis and a NetScreen router*

These How To Notes are available in the Resource Center of the Documentation and Tools CDROM for Software Version 2.9.1, or from www.alliedtelesis.co.uk/site/solutions/techdocs.asp?area=howto.

Command Changes

This enhancement does not affect any commands.

System Enhancements

This Software Version includes the following enhancements to the System:

- Activate Findme Feature
- Enhanced Protection for Filenames
- Increased Module Support by Show Debug Active

This section describes the enhancements. The new and modified commands to implement them are described in Command Reference Updates.

Activate Findme Feature

On AT-8800 Series switches, Software Version 2.9.1 enables you to physically locate a specific switch from others that are co-located. Running the **activate findme** command causes all switch port LEDs to flash green and amber at a rate of 0.5Hz. Normal LED behaviour will be restored automatically after either the default time, or specified time, has elapsed. The **time** parameter specifies the time period until normal LED behaviour is restored.

To locate a specific AT-8800 Series switch by causing its LEDs to flash, use the command:

```
activate findme [time=time]
```

To stop the LEDs from flashing, use the command:

```
deactivate findme
```

Command Changes

The following table summarises the new commands:

Command	Change
activate findme	New command
deactivate findme	New command

Enhanced Protection for Filenames

This Software Version protects the preferred software release and current boot configuration files from being renamed.

Previously, you could rename the current boot configuration file using the command **rename**. This stopped the router or switch from running that configuration on boot-up, so if the router or switch restarted after the user had renamed the current boot configuration file, it started up with no configuration.

Command Changes

This enhancement does not affect any commands.

Increased Module Support by Show Debug Active

This Software Version increases the number of modules supported by the **show debug active** and **disable debug active** commands. See "Supported Modules" on page 15 for the list of newly supported modules.

To display the debugging options that are active on the router or switch for the supported modules, use the command:

```
show debug active={all|module}
```

To disable debugging on the supported modules, use the command:

```
disable debug active={all|module}
```

Command Changes

The following table summarises the modified commands:

Command	Change
disable debug active	New module options for **active** parameter
show debug active	New module options for **active** parameter

Command Reference Updates

This section describes each new command and the changed portions of modified commands and output screens. For modified commands and output, the new parameters, options, and fields are shown in bold.

activate findme

Syntax `ACTivate FINdme [TIme=time]`

Description This command enables you to physically locate a specific switch from others that are co-located. This command causes the switch's LEDs to flash green and amber at a rate of 0.5 Hzs. Normal LED behaviour is restored automatically after either the default time, or a specified time, has elapsed, or manually by using the **deactivate findme** command.

The **time** parameter specifies the time period until normal LED behaviour is restored. The duration can be set between 10 and 3600 seconds. The default is **60**.

Examples To activate the "find me" feature for the default amount of time, use the command:

```
act fin
```

To activate the "find me" feature for 2 minutes (120 seconds), use the command:

```
act fin ti=120
```

deactivate findme

Syntax `DEACTivate FINdme`

Description This command deactivates the findme LED flash pattern and returns the LED displays to their normal mode.

Example To deactivate the “find me” feature, use the command:

```
deact fin
```

disable debug active

Syntax `DISable DEBug ACTive={ALL|`*`module`*`}`

where *module* is the predefined name of a module

Description This command disables currently enabled debugging, either for a specific module or for all modules. This command now supports additional modules. See “Supported Modules” on page 15 for a list of additional modules.

show debug active

Syntax `SHow DEBug ACTive={ALL|`*`module`*`}`

where *module* is the predefined name of a module

Description This command displays information about module-specific debugging currently enabled on the router or switch. The following table lists the new modules supported by this command and their related debug commands. Please note that your router or switch, depending on its feature set, may not support all the modules included this list.

Supported Modules

Module	Related Debugging Commands
BOOTp	disable bootp relay option82 debug enable bootp relay option82 debug
BRI (BRI driver)	disable bri debug enable bri debug show bri debug
DHCP	disable dhcp debug enable dhcp debug
DHCP6	disable dhcp6 debug enable dhcp6 debug
DHCPSnooping	disable dhcpsnooping debug enable dhcpsnooping debug
DVMrp	disable dvmrp debug enable dvmrp debug
ENCO	disable enco debugging enable enco debugging

Module	Related Debugging Commands
FIREwall	disable firewall policy debug enable firewall policy debug
FRamerelay	disable framerelay debug enable framerelay debug
GARP	disable garp debug enable garp debug show garp debug
GRE	disable gre debug enable gre debug
HTTP	disable http debug enable http debug show http debug
IPSec	disable ipsec policy debug enable ipsec policy debug
IPV6	disable ipv6 debug disable ipv6 mld debug disable mldsnooping debug enable ipv6 debug enable ipv6 mld debug enable mldsnooping debug show ipv6 mld debug
ISAkmp	disable isakmp debug enable isakmp debug
LOADBalancer	disable loadbalancer debug enable loadbalancer debug
LDAP	disable ldap debug enable ldap debug
LLDP	disable lldp cdp debug enable lldp cdp debug
MAIL	disable mail debug enable mail debug
PIM6	disable pim6 debug enable pim6 debug show pim6 debug
PING	disable ping poll debug enable ping poll debug
PKI	disable pki debug enable pki debug
POE	disable poe debug enable poe debug
PORTAuth	disable portauth debug enable portauth debug
PPP	disable ppp debug disable ppp template debug enable ppp debug enable ppp template debug
PRI (PRI driver)	disable pri debug enable pri debug

Module	Related Debugging Commands
QOS	disable qos debug enable qos debug
RSVP	disable rsvp debug enable rsvp debug
SHDsl	disable shdsl debug enable shdsl debug
SQOS (Software QOS)	disable sqos debug enable sqos debug
SSH	disable ssh debug enable ssh debug
SSL	disable ssl debug enable ssl debug
STAck	disable stack debug enable stack debug
STAR	disable star debugging enable star debugging
TCP	enable tcp debug disable tcp debug
TELnet	disable rtelnet debug enable rtelnet debug
VLAN	disable vlan debug enable vlan debug show vlan debug
VOIP	disable voip debug enable voip debug
WANLB	disable wanlb debug enable wanlb debug

Switching Enhancements

This Software Version includes the following enhancements to Switching:

- **Multiple Uplink Ports in Private VLANs**
- **Group Parameter Required for Private VLAN Ports**

This section describes the enhancements. The modified commands to implement them are described in **Command Reference Updates**.

Multiple Uplink Ports in Private VLANs

This enhancement makes it possible to add multiple uplink ports to a private VLAN on Rapier i, AT-8600, AT-8700XL, and AT-8800 Series switches. This enables you to use private VLANs in a ring or meshed topology.

To add the uplink ports, specify the list of ports in the existing command:

```
add vlan={vlan-name|1..4094} port=port-list
   [frame={untagged|tagged}] uplink
```

For Rapier 48i and AT-8748XL switches, note that all ports in the private VLAN must be in the same switch instance. See the *Switching* chapter of the Software Reference for more information.

Command Changes

This enhancement does not affect any commands.

Group Parameter Required for Private VLAN Ports

With Software Version 2.9.1, when you add a trunk group to a private vlan as private ports, you must specify the **group** parameter.

The **add switch trunk** and **create switch trunk** commands now check that all ports belong to the same group if they belong to the same private VLAN.

Command Changes

The following table summarises the modified command:

Command	Change
add vlan port	Modified behaviour for the **group** parameter

Command Reference Updates

This section describes the changed portions of the modified command. The modified parameter is shown in bold.

add vlan port

Syntax

```
ADD VLAN={vlan-name|1..4094} POrt={port-list|ALL}
   [FRAme={TAGged|UNTAGged}] [UPLINk] [GROUP]
```

Description When adding a trunk group to a private VLAN as private ports, you now must specify the **group** parameter.

Power Over Ethernet Enhancements

This Software Version includes the following enhancement to Power over Ethernet (PoE):

- **PoE Firmware Upgrade**

This section describes the enhancement. The new commands to implement it are described in **Command Reference Updates**.

PoE Firmware Upgrade

Software Version 2.9.1 introduces the ability to upgrade PoE firmware via the CLI. In addition, you can also enable and disable a range of debugging modes for Power over Ethernet.

Command Changes

The following table summarises the new commands:

Command	Change
disable poe debug	New command
enable poe debug	New command
set poe firmware	New command
show poe version	New command

Command Reference Updates

This section describes each new command.

disable poe debug

Syntax `DISable POE DEBug=[ALL|DEBug|TRAce|ERRor|FATal|TESt]`

Description This new command disables the specified PoE debugging modes.

Parameter	Description	
DEBug	The debugging modes to disable. Default: **all**	
	ALL DEBug	Disables all PoE debugging
	TRAce	Disables only high-level, essential debugging, for example, information about message types
	ERRor FATal	Disables only the debugging of any error conditions that may occur during PoE operation.
	TESt	Disables only the test debugging mode

Examples To disable all PoE debugging, use one of the commands:

```
dis poe deb=all
dis poe debug=deb
```

To disable high-level, essential debugging, use the command:

```
dis poe deb=tra
```

enable poe debug

Syntax `ENAble POE DEBug=[ALL|DEBug|TRAce|ERRor|FATal|TESt]`

Description This new command enables the specified PoE debugging modes.

Parameter	Description	
DEBug	The debugging modes to enable. Default: **all**	
	ALL DEBug	Enables all PoE debugging
	TRAce	Enables only high-level, essential debugging, for example, information about message types
	ERRor FATal	Enables only the debugging of any error conditions that may occur during PoE operation.
	TESt	Enables only the test debugging mode

Example To enable error debugging, use one of the commands:

```
ena poe deb=err
ena poe deb=fat
```

set poe firmware

Syntax `SET POE FIRMware=`*`filename`*

where *filename* is the name of a valid firmware file that is already present in the flash. A valid firmware file must be either Version 2.9.0 or 5.0.1, and have the extension .s19.

Description This new command upgrades the PoE firmware in the PoE Controller, if the AT-8600 Series switch finds valid PoE firmware in its flash. Firmware is downloaded to the flash using the **load** command. See the *Managing Configuration Files and Software Versions* chapter in the Software Reference for command details.

The switch prompts you for confirmation before it begins upgrading the firmware. The upgrade may take a while to complete, depending on the size of your firmware file.

You must not restart the switch while the firmware upgrade is in progress. If you restart the switch, the firmware upgrade will terminate abruptly, which will corrupt the firmware and cause PoE operations to fail in the subsequent startup.

During the upgrade the following limitations apply:

- Other PoE commands do not execute.
- You cannot use any PoE ports for powered devices, as Power over Ethernet is temporarily disabled. However, any non-powered devices that are connected to PoE ports will continue to operate normally.
- You should avoid deleting, re-naming, or copying any files.

All PoE configurations are restored once the upgrade has successfully completed. You do not need to reconfigure PoE or restart the switch for the new firmware to take effect.

The new firmware version is permanently stored in the PoE hardware. This remains in the PoE hardware even if you delete the .sig file from flash memory.

Example To download the PoE firmware file v2.9.0 to the PoE Controller, use the command:

```
set poe firm=pol30k.s19
```

show poe version

Syntax `SHow POE VERsion`

Description Use this command to display the version number of the PoE firmware that is currently running on your AT-8600 Series switch.

Figure 1: Example output from the **show poe version** command

```
PoE version information:
Firmware version .... 2.9.0
```

Example To display the PoE firmware version number, use the command:

```
sh poe ver
```

SHDSL Enhancements

This Software Version includes the following enhancement to SHDSL:

- **ITU Standard Mode Operation**

This section describes the enhancement. The modified commands to implement it are described in **Command Reference Updates**.

ITU Standard Mode Operation

On the AR442S router, Software Version 2.9.1 enables you to set SHDSL operation for either standards-based, or enhanced 2-pair, modes of operation. The standards-based 2-pair mode is compatible with ITU standard G.991.2 (12/2003). The Enhanced 2-pair mode was initially developed prior to the finalization of the ITU standard, and is therefore not compatible with standards-based DSLAMs. Standards-based 2-pair mode is advisable for most installations, but enhanced mode may be useful in circumstances where it is compatible with the DSLAM.

To set the wire mode for SHDSL, use the command:

```
set shdsl=interface
   [pairmode={2wire|4wirestandard|4wireenhanced|
   1pair|2pairstandard|2pairenhanced}] [other-options]
```

To see the wire mode that an SHDSL interface is set to, use the command:

```
show shdsl={interface|all} linedetails
```

Command Changes

The following table summarises the modified commands:

Command	Change
set shdsl	New options for **pairmode** parameter
show shdsl linedetails	New **Pair mode** field in output

Command Reference Updates

This section describes the changed portions of modified commands and output screens. The new parameters, options, and fields are shown in bold.

set shdsl

Syntax

```
SET SHDsl=interface [MOde={CPE|CO}]
   [PAIRmode={2Wire|4WIREStandard|4WIREEnhanced|
   1Pair|2PAIRStandard|2PAIREnhanced}]
   [STAndard={ANNEXA|ANNEXB|BOTH|ANNEXBAnfp|BOTHAnfp}]
   [PSDmask={SYMmetric|ASYMetric}] [AUTOretrain={ON|OFF}]
   [BITratemode=ADAptive|FIXed] [MINbitrate=72..4624]
   [MAXbitrate=72..4624] [ATTENuationthreshold=0..31]
   [SNRmarginthreshold=0..15]
```

Description

This command configures the SHDSL interface. The SHDSL interface must be disabled using the **disable shdsl** command before any parameters can be configured on the interface.

Parameter	Description	
PAIRmode	Selects whether the SHDSL interface attempts to transmit data over 1 pair or 2 pairs (2 wires or 4 wires). For 2 pair operation the parameter also selects either a standards-based mode, or a non-standards based enhanced mode. Default: **1Pair**	
	1Pair, 2Wire	A single pair of wires (2 wires).
	2PAIRStandard, 4WIREStandard	Two pairs of wires (4 wires) operating in standards based mode (ITU standard G.991.2). In this mode, the **bitratemode** parameter must be set to **fixed**. Automatic fallback to single-pair mode is not supported.
	2PAIREnhanced, 4WIREEnhanced	Two pairs of wires (4 wires) operating in non-standards based, enhanced mode. In this mode, the **bitratemode** parameter must be set to **fixed**. Automatic fallback to single-pair mode is supported by compatible DSLAMs.

Example

To set SHDSL interface 0 to 2pairstandard mode, use the command:

```
set shd=0 pair=2pairs bit=fix max=4624
```

show shdsl linedetails

Syntax `SHow SHDsl={`*`interface`*`|ALL} LINEdetails`

Description This command displays the current negotiated configuration information for the specified SHDSL interface or all SHDSL interfaces. If the SHDSL interface is not in the data state, the parameters displayed in the output are the last received or known parameters for the connection.

Figure 2: Example output from the **show shdsl linedetails** command

```
SHDSL Line Details
------------------------------------------------------------------------------
shdsl0:
                                Pair 1              Pair 2
                                ------              ------
  Standard ..................... Annex A            Annex A
  Pair mode ..................... 2 pair standard    2 pair standard
  .
  .
  .
```

Table 1: New parameters in the output of the **show shdsl linedetails** command

Parameter	Meaning
Pair mode	Whether the SHDSL line is operating in 1-pair or 2-pair mode, and if in 2-pair mode whether it is in standards-based or enhanced mode.

Bridging Enhancements

This Software Version includes the following enhancements to Bridging:

- VLAN to WAN Bridging
- Retaining or Stripping VLAN Tags

This section describes the enhancements. The new and modified commands to implement them are described in Command Reference Updates.

VLAN to WAN Bridging

Software Version 2.9.1 includes the ability to bridge between VLANs over a PPP WAN link.

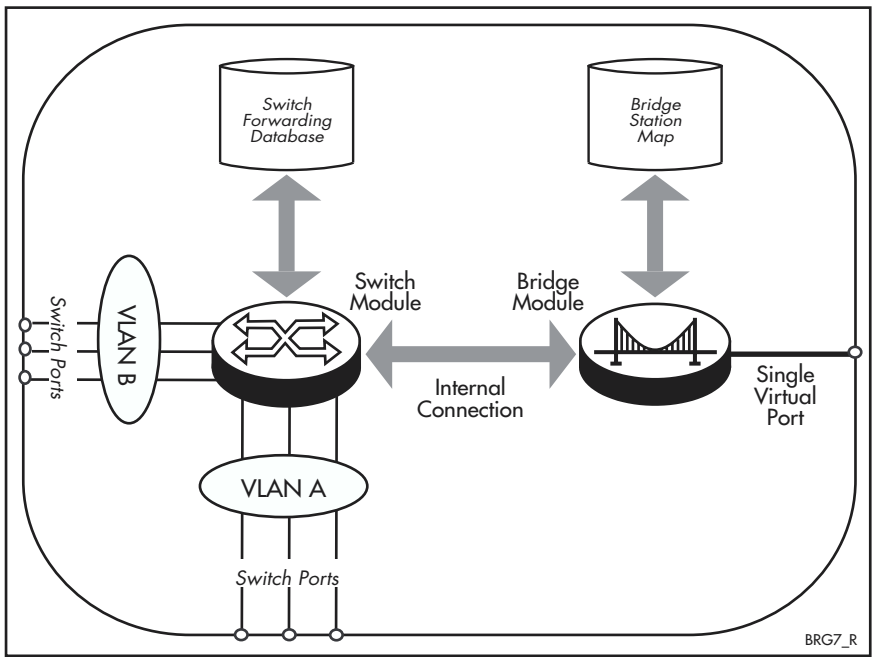
In general, it is better to route a protocol than to bridge it. However, sometimes bridging is a more appropriate solution, particularly where unroutable upper layer protocols are used. These protocols sometimes produce high levels of broadcast messages that can overload a network, an effect that gets progressively worse as the number of devices increases. Although this situation may not pose a problem to the high bandwidths available on local area networks, it could heavily congest the more limited bandwidths available on wide area links. This effect can be reduced by adding a VLAN to a bridge and then limiting the VLAN to devices that require wide area connections. The remote VLAN bridge is able to support up to 16 VLANs.

Internal Representation of the VLAN-to-WAN Bridge

The router contains both a switch module and a bridge module. This section explains how these modules provide the learning and forwarding functions for the VLAN-to-WAN bridge.

Figure 3 shows an internal representation of the VLAN-to-WAN bridge that exists on the AR400 and AR700 Series routers. Note that the bridge and switch symbols are internal functional representations and are not standalone devices.

Figure 3: Internal representation of the switch's VLAN-to-WAN bridge



Switch ports within each VLAN connect to the switch module, to obtain layer two connectivity (local or remote) for their attached devices. An internal data path, shown by the horizontal grey arrow, provides connectivity between the two modules.

The VLAN-to-WAN Bridging Process

The switch module provides layer two connectivity for locally attached ports within the same VLAN. An internal data connection, shown by the horizontal grey arrow in Figure 3, provides connectivity between the two modules. The *switch forwarding database*, and the *bridge station map* both employ their own respective processes to learn the addresses of their attached devices.

Local devices within the same VLAN, utilise the forwarding database and their traffic is switched by hardware at layer two. Remote devices within the same VLAN, utilise both the forwarding database and the station map, hence their traffic is *remote bridged* across the wide area link.

The switch module examines the MAC addresses of frames received on its switch ports. If it recognises an address as belonging to a locally attached device, it forwards the frame to the appropriate port. If it recognises a frame's MAC address as belonging to a device residing over the wide area link, it forwards the frame to the bridge module via the internal connection shown. The bridge module then forwards the frame across the wide area link.

VLAN-to-WAN data always crosses the wide area link as tagged frames. At the link's remote end, the bridge may either retain the VID tags for forwarding the frames to a tagged port, or remove the VID tags for forwarding the frames to an untagged port within the VLAN. For this reason, you must set the **set bridge stripvlantag** command to **off**.

VLAN-to-WAN Bridge Configuration

Figure 4 shows a simple remote VLAN connection. A company has its head office at location A and its training centre at location B. In location B, a training server provides computer based training programs that are accessible from selected user PCs located at both sites. Unfortunately, the training application operates over an unroutable protocol.

To solve this problem, a single VLAN is created for the training PCs and a remote VLAN connection lets them access the wide area link.

Figure 4: Example configuration for a remotely bridged VLAN

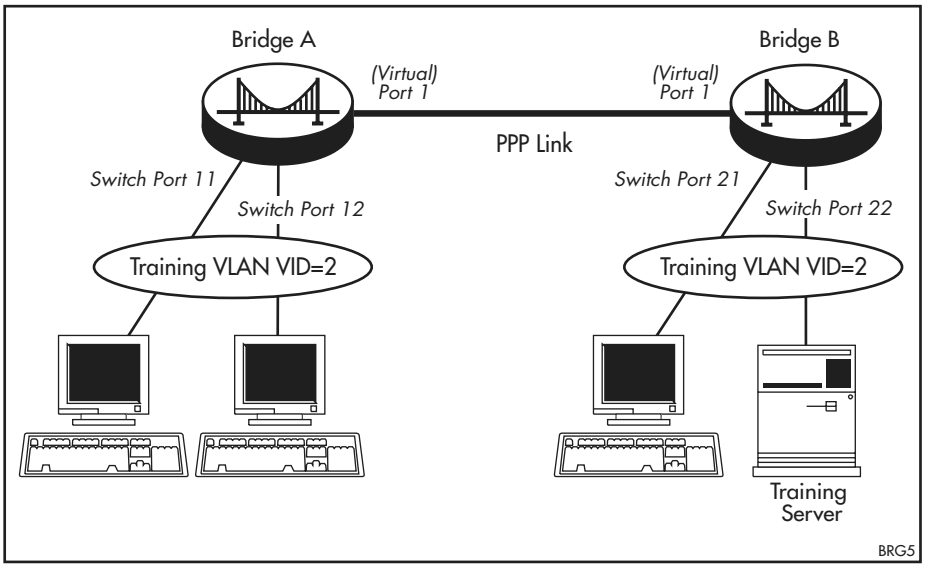


Table 2: VLAN membership in example of a network using tagged ports

VLAN	Member ports
Training	11, 12 on Bridge A
	21, 22 on Bridge B

To configure VLAN-to-WAN bridge A

1. **Ensure that the set bridge stripvlantag command is set to OFF.**

2. **Create the VLAN to be used for the training devices.**

   Because the default VLAN with VID 1 may already exist, assign a VLAN with VID 2 for the training devices with the command:

   ```
   create vlan=Training vid=2
   ```

3. **Add switch ports to the VLAN.**

   To add switch ports to the Training VLAN, use the command:

   ```
   add vlan=Training port=11,12
   ```

4. **Add the VLAN to the bridge.**

   To add the VLAN to the bridge, use the command:

   ```
   add vlan=2 bridge
   ```

5. **Create a WAN interface.**

   To create a PPP interface over a synchronous port or other interface, use the command:

   ```
   create ppp=0 over=syn0
   ```

6. **Configure the bridge ports.**

   To enable the bridge module and add the PPP interface as a virtual port, use the commands:

   ```
   enable bridge
   set bridge stripvlantag=no
   add bridge port=1 int=ppp0
   ```

To configure VLAN-to-WAN bridge B

1. **Create the Training VLAN.**

   To create a Training VLAN with VID 2 to be used for VLAN-to-WAN bridging, use the command:

   ```
   create vlan=Training vid=2
   ```

2. **Add switch ports to the VLAN.**

   To add switch ports to the Training VLAN, use the command:

   ```
   add vlan=Training port=21,22
   ```

3. **Add the VLAN to the bridge.**

   To add the VLAN to the bridge, use the command:

   ```
   add vlan=2 bridge
   ```

4. **Create a WAN interface.**

   To create a PPP interface over a synchronous port or other interface, use the command:

   ```
   create ppp=0 over=syn0
   ```

5. **Configure the bridge ports.**

   To enable the bridge module and add the PPP interface as a virtual port, use the commands:

   ```
   enable bridge
   set bridge stripvlantag=no
   add bridge port=1 int=ppp0
   ```

For more information about configuring Frame Relay and PPP, see the *Point-to-Point Protocol (PPP)* chapter of your Software Reference.

Command Changes

The following table summarises the new commands:

Command	Change
add vlan bridge	New command
delete vlan bridge	New command

Retaining or Stripping VLAN Tags

By default, when an AR400 or AR700 Series router receives a tagged packet on an Eth or VLAN interface and bridges it, the bridge strips out the packet's VLAN tag. This enhancement enables you to set the bridge to instead retain the tag, by using **off**, **no** or **false** in the new command:

```
set bridge stripvlantag={on|off|yes|no|true|false}
```

The default is **on**. To see whether stripping is turned on or off, use the command:

```
show bridge
```

and check the new **StripVlantag** field.

Command Changes

The following table summarises the new and modified commands:

Command	Change
set bridge stripvlantag	New command
show bridge	New **StripVlantag** field

Command Reference Updates

This section describes each new command and the changed portions of modified commands and output screens. For modified commands and output, the new parameters, options, and fields are shown in bold.

add vlan bridge

Syntax

```
ADD VLAN={vlan-name|1..4094} BRIDge
   [DEVICELimit={NONE|1..250}]
   [AGEingtimer{NONE|0..10000001}]
```

- where *vlan-name* is a unique name for the VLAN 1 to 32 characters long. Valid characters are uppercase and lowercase letters, digits, the underscore, and hyphen. The *vlan-name* cannot be a number or **all**.

Description

This command enables bridging between the switch ports that are members of the specified VLAN, and a single virtual port configured on the bridge. The VLAN forwards all frames to the bridge's single virtual port. Frames destined for remote stations are forwarded to the wide area port. Frames destined for stations on the local bridge are sent to the VLAN and port appropriate to that station.

The **vlan** parameter specifies a VLAN. Up to 16 VLANs can be configured using this command, but each must be separately entered.

For PPP operation a maximum of 16 VLANs can be attached to the bridge. When multiple VLANs are attached to the bridge, all the frames transmitted or received by the bridge must be VLAN tagged. To ensure this you must configure the set bridge stripvlantag to **no**.

The **devicelimit** parameter sets the maximum number of devices connected to the VLAN that can send packets over the VLAN to WAN bridge. If **none** is

specified, this means there is no limit to the number of devices. The default is **none**.

The **ageingtimer** parameter sets the number of seconds before an unused MAC entry will be removed. When **none** is specified, no time limit is set. The default is **none**.

Examples To attach the training VLAN to the bridge, use the command:

```
add vlan=training bridg
```

To attach the training VLAN to the bridge for 20 devices with an ageing timer of 1 hour (3600 seconds), use the command:

```
add vlan=training bridg devicel=20 age=3600
```

delete vlan bridge

Syntax `DElete VLAN={`*`vlan-name`*`|1..4094} BRIDge`

where *vlan-name* is a unique name for the VLAN 1 to 32 characters long. Valid characters are uppercase and lowercase letters, digits, the underscore, and hyphen. The *vlan-name* cannot be a number or **all**.

Description This command deletes a bridge attachment from the specified VLAN.

Example To delete the training VLAN from the bridge use the command:

```
del vlan=training brid
```

set bridge stripvlantag

Syntax `SET BRIDge STripvlantag={ON|OFF|YES|NO|True|False}`

Description This command determines whether the bridge strips out the VLAN tag of tagged packets, when it receives them on Eth or VLAN interfaces and bridges them.

If you specify **on**, **yes**, or **true**, the bridge strips the tag. If you specify **off**, **no**, or **false**, the bridge retains the tag. The default is **on**.

Example To retain the VLAN tag, use the command:

```
set brid st=off
```

show bridge

Syntax `SHow BRIDge`

Description The output of this command includes a new field (Figure 5, Table 3).

Figure 5: Example output from the **show bridge** command

```
Remote Bridge
-------------------------------------------------------------
Bridge Address           : 00-00-cd-00-0d-4d
Bridge Name              : Example version 2.7.6-00 1 May 2006
Spanning Tree Protocol   : ON
Filter Learning          : ON
Number LAN Ports         : 2
    Port Number          : 1
    Port Address         : 00-00-cd-00-0d-4d
    CAM                  : Enabled
    Port Number          : 2
    Port Address         : 00-00-cd-00-0d-82
    CAM                  : Enabled
Number of Virtual Ports  : 1
Port Number              : 3
Number of Groups         : 1
Ageingtime               : 300
Uptime                   : 12133
StripVlantag             : TRUE
-------------------------------------------------------------
```

Table 3: New parameters in the output of the **show bridge** command

Parameter	Meaning
StripVlantag	Whether the bridge strips out the VLAN tag of tagged packets when it receives them on Eth or VLAN interfaces and bridges them (“TRUE”), or retains the VLAN tag (“FALSE”).

Internet Protocol (IP) Enhancements

This Software Version includes the following enhancements to IP:

- Dynamic DNS Client
- Preventing MAC Address Resolution Between Hosts Within a Subnet
- IP Debug Timeout
- Show IP Interface Command Displays Gratuitous ARP Status

This section describes the enhancements. The new and modified commands to implement them are described in Command Reference Updates.

Dynamic DNS Client

Software Version 2.9.1 enables you to configure the router as a dynamic DNS client, for operation with the service offered by DynDNS (see www.dyndns.com/services/dns/). This feature is available on AR400 Series routers and AR750S, AR750S-DP, and AR770S routers.

The dynamic DNS client allows you to associate the router's public IP address with up to five "hostnames" (FQDNs) registered with DynDNS.com. When the router's public IP address changes, the dynamic DNS client sends an HTTP update to DynDNS.com, notifying them of the address change. DynDNS.com then associates the new IP address with your registered hostnames, and propagates this change through the DNS system.

This means that you can host servers behind the router's public IP address without actually owning your own domain name, and even if your public IP address changes periodically.

Configuring Dynamic DNS

To configure dynamic DNS, perform the following steps:

1. Register with DynDNS.com and select a domain name to use
2. Enable dynamic DNS, by using the command:

```
enable ddns
```

3. Specify the hostname, interface, username, and password for the client to use, and other options if required, by using the command:

```
set ddns [server=server] [port=port] [user=userid]
    [password=password] [dynamichost=hostnames]
    [customhost=hostnames] [statichost=hostnames]
    [primaryint=interface] [secondaryint=interface]
    [wildcard={on|off|nochg}]
    [mailexchanger={mailexchanger|nochg}]
    [backmx={yes|no|nochg}] [offline={yes|no}]
```

4. Check that the client is correctly sending updates, by using the command:

```
show ddns
```

For a detailed step-by-step example and troubleshooting tips, see *How To Use Dynamic DNS To Allow You To Host Servers Behind A Dynamically-Assigned Public IP Address*. This How To Note is available in the Resource Center of the Documentation and Tools CDROM for Software Version 2.9.1, or from www.alliedtelesis.co.uk/site/solutions/techdocs.asp?area=howto.

Command Changes

The following table summarises the new commands:

Command	Change
activate ddns update	New command
disable ddns	New command
disable ddns debug	New command
enable ddns	New command
enable ddns debug	New command
set ddns	New command
show ddns	New command

Preventing MAC Address Resolution Between Hosts Within a Subnet

A new feature lets you stop MAC address resolution between hosts within an interface's subnet. Local proxy ARP ensures that devices within a subnet cannot send traffic that bypasses the router or switch. This lets you monitor, filter, and control traffic between devices in the same subnet.

Local proxy ARP extends proxy ARP by intercepting and responding to ARP requests between hosts within a subnet. It responds to the ARP requests with the router or switch's own MAC address details instead of those from the destination host. This stops hosts from learning the MAC address of other hosts within its subnet.

When local proxy ARP is operating on an interface, the router or switch does not generate or forward any ICMP-Redirect messages on that interface.

To create an interface that uses local proxy ARP, use the command:

```
add ip interface=interface ipaddress={ipadd|dhcp}
   proxyarp=local [other-options]
```

To change an interface to use local proxy ARP, use the command:

```
set ip interface=interface ipaddress={ipadd|dhcp}
   proxyarp=local [other-options]
```

Command Changes

The following table summarises the modified commands:

Command	Change
add ip interface	New **local** option for **proxyarp** parameter
set ip interface	New **local** option for **proxyarp** parameter
show ip interface	Existing **proxyarp** field displays the setting of the **local** option

IP Debug Timeout

This enhancement makes it possible to specify a timeout value when enabling IP debugging. After the timeout expires, IP debugging is automatically disabled. This helps to prevent problems from too much IP debugging clogging up the display.

To specify the timeout, use the new optional **timeout** parameter in the command:

```
enable ip debug={all|arp|packet|advertise|upnp}
    [timeout={none|1..2400}]
```

The **timeout** units are seconds.

For example, to enable ARP debugging and display the debugging information for the next 25 seconds, use the command:

```
enable ip debug=arp timeout=25
```

To see the current timeout value, use the **show debug active[=ip]** command. The current timeout is shown above the types of IP debugging that are currently enabled (Figure 7 on page 43).

Command Changes

The following table summarises the modified commands:

Command	Change
enable ip debug	New **timeout** parameter
show debug active	New **IP Debug Timeout** field

Show IP Interface Command Displays Gratuitous ARP Status

This Software Version includes an additional field in the output in the **show ip interface** command. This displays whether the interface accepts or rejects gratuitous ARPs.

Gratuitous ARP packets are ARP messages that are not required for the functioning of ARP (RFC 826). However, they are often sent by devices to aid with early detection of IP conflicts and to keep ARP tables in other routers or switches up to date. To configure whether an interface accepts or rejects these messages, use the command:

```
set ip interface[=interface] gratuitousarp={off|on}
```

To see which interfaces on the router or switch accept gratuitous ARP request or reply messages, use the command:

```
show ip interface[=interface]
```

Command Changes

The following table summarises the modified command:

Command	Change
show ip interface	New **GArp** field in output

Command Reference Updates

This section describes each new command and the changed portions of modified commands and output screens. For modified commands and output, the new parameters, options, and fields are shown in bold.

activate ddns update

Syntax

```
ACTivate DDNS UPdate
```

Description This command activates a Dynamic DNS update.

Examples To force a router to send a Dynamic DNS update, use the command:

```
act ddns up
```

add ip interface

Syntax

```
ADD IP INTerface=interface IPaddress={ipadd|DHCP}
   [ADVertise={YES|NO}] [BROadcast={0|1}]
   [DIRectedbroadcast={False|NO|OFF|ON|True|YES}]
   [FILter={0..999|NONE}] [FRAgment={NO|OFF|ON|YES}]
   [GRAtuitousarp={ON|OFF}] [GRE={0..100|NONE}]
   [IGMPProxy={OFF|UPstream|DOWNstream}]
   [INVersearp={ON|OFF}] [MASK=ipadd] [METric=1..16]
   [MULticast={BOTH|NO|OFF|ON|RECeive|SENd|YES}]
   [OSPFmetric=1..65534] [POLicyfilter={0..999|NONE}]
   [PREferencelevel={-2147483648..2147483647|NOTDEFAULT}]
   [PRIorityfilter={0..999|NONE}]
   [PROxyarp={DEFRoute|False|LOCal|NO|OFF|ON|STrict|True|
   YES}] [RIPMetric=1..16] [SAMode={Block|Passthrough}]
   [VJC={False|NO|OFF|ON|True|YES}]
   [VLANPRiority={0..7|None}] [VLantag={1..4094|None}]
```

Description The new **local** option for **proxyarp** increases the range of ARP Requests that the router or switch responds to. When you specify **yes**, **on**, **true** or **strict**, the router or switch only responds to ARP Requests with a specific route if it exists, and ignores all others. When you specify **local**, the router or switch responds for routes it has a specific route to, and routes within its local subnet that would normally be IGMP redirected. By intercepting and responding to these local ARP requests, the router or switch prevents hosts within the subnet from successfully using MAC address resolution to communicate directly with one another. Instead, traffic between hosts is forwarded through the router or switch.

disable ddns

Syntax `DISable DDNS`

Description This command disables the Dynamic DNS feature.

Example To disable the DDNS feature, use the command:

```
dis ddns
```

disable ddns debug

Syntax `DISable DDNS DEbug`

Description This command disables the Dynamic DNS debug facility.

Example To disable DDNS debugging, use the command:

```
dis ddns de
```

enable ddns

Syntax `ENAble DDNS`

Description This command enables the Dynamic DNS feature.

Example To enable the DDNS feature, use the command:

```
ena ddns
```

enable ddns debug

Syntax `ENAble DDNS DEBug`

Description This command enables the Dynamic DNS debug facility.

Example To enable DDNS debugging, use the command:

```
ena ddns deb
```

enable ip debug

Syntax `ENAble IP DEBug={ARP|PACket|ADVertise|UPNP|ALL}`
`[TIMEOut={NONE|1..2400}]`

Description The new **timeout** parameter specifies the time period, in seconds, for which IP debugging is enabled. Setting a timeout reduces the risk of overloading the router or switch and the display with too much debugging information. The value set by the **timeout** parameter overrides any previous IP debugging timeout values, even if they were specified for other debugging options. The default is the timeout value used the last time that this command was run, or **none**.

To change the current timeout value, re-enter the command **enable ip debug={arp | packet | advertise | upnp | all} timeout={none | 1..2400}**. A value of **none** turns the timeout off.

Note that you can also enter the command **enable ip debug** without specifying an option on the **debug** parameter. This starts a different debugging mode, in which IP stores the header and the reason for rejection of the 40 most recent incorrectly formatted IP packets. You can then display the stored information by using the **show ip debug** command. The new **timeout** parameter has no effect when debugging is in this mode.

Examples To display ARP debugging information for the next 25 seconds, use the command:

```
enable ip debug=arp timeout=25
```

To enable all debug options indefinitely, use the command:

```
enable ip debug=all timeout=none
```

set ddns

Syntax

```
SET DDNS [SERVER=server] [PORT=port] [USer=userid]
   [PASSword=password] [DYNamichost=hostnames]
   [CUSTomhost=hostnames] [STAtichost=hostnames]
   [PRImaryint=interface] [SECOndaryint=interface]
   [WILdcard={ON|OFF|NOCHG}]
   [MAIlexchanger={mailexchanger|NOCHG}]
   [BAckmx={YES|NO|NOCHG}] [OFFline={YES|NO}]
```

Description This command sets the parameters used for updating the Dynamic DNS.

Parameter	Description
SERVER	The name of the DDNS server. It is a string of up to 31 characters, having a URL name format. Default: **members.dyndns.org**
PORT	Specifies the remote port number to be used by a local HTTP client in order to convey the Dynamic DNS Update. Only port numbers 80, 8245 and 443 can be used. Ports 80 and 8245 are for HTTP, and port 443 is for HTTPS. Port 8245 may be used to bypass transparent HTTP proxies. Default: **80**
USer	A user name used for an account with Dynamic DNS. It may contain up to 15 printable characters and is case sensitive. If the name contains spaces, these must be enclosed in double quotes. Default: no default.
PASSword	A password to be used with Dynamic DNS account. It may contain up to 15 printable characters and is case sensitive. If the password contains spaces, these must be enclosed in double quotes. Default: no default.
DYNamichost	Host names to be used with Dynamic DNS. Each name may contain up to 31 printable characters having a URL format. If a name contains spaces, these must be enclosed in double quotes. Up to four comma separated names can be entered. All names must be Internet registered. Defaults: no default.
CUSTomhost	Host names for Custom DNS. Each name may contain up to 31 printable characters having a URL format. If a name contains spaces, these must be enclosed in double quotes. Up to four comma separated names can be entered. All names must be Internet registered. Defaults: no default.
STAtichost	Host names to be used for Static DNS. Each name can be up to 31 printable characters long and is case sensitive. Up to four comma separated names can be entered. Default: no default.
PRImaryint	An interface to be used for the primary WAN connection. The IP interface must be pre-defined. Default: no default.
SECOndaryint	The interface to be used for the secondary WAN connection. The IP interface must be pre-defined. Default: no default.

Parameter (cont.)	**Description** (cont.)	
WILdcard	Whether to use the wildcard * feature when matching host names. Default: **off**	
	ON	Turns on the wildcard option.
	OFF	Turns off the wildcard option.
	NOCHG	Retains the previous wildcard value.
MAIlexchanger	A mail exchanger to be used with the hostname. The mail exchanger is a string of up to 31 characters. Although the router or switch accepts any printable character string, DynDNS requires a specific format such as a URL address. Default: no default	
	mailexchanger	The mail exchanger name. It must be one that can be resolved to an IP address or it is ignored. By not providing a mail exchanger name or entering one that does not resolve to an A record, you will remove the record of the hostname.
	NOCHG	Preserves the current **mailexchanger** setting.
BAckmx	Whether the mail exchanger specified by the **mailexchanger** parameter is set up as a backup. Default: **no**	
	Yes	The **mailexchanger** is set as the backup.
	No	The **mailexchanger** is not set as the backup.
	NOCHG	Retains the existing setting.
OFFline	Whether to set the hostnames to offline mode. Default: **no**	

Example To set the DDNS operation for a user called Oliver, use the command:

```
set ddns us=oliver pas=fagin pri=ppp0
```

set ip interface

Syntax

```
SET IP INTerface=interface [ADVertise={YES|NO}]
   [PREferencelevel={-2147483648..2147483647|NOTDEFAULT}]
   [BROadcast={0|1}]
   [DIRectedbroadcast={False|NO|OFF|ON|True|YES}]
   [FILter={0..999|NONE}] [FRAgment={NO|OFF|ON|YES}]
   [GRAtuitousarp={ON|OFF}] [GRE={0..100|NONE}]
   [IGMPProxy={OFF|UPstream|DOWNstream}]
   [INVersearp={ON|OFF}] [IPaddress=ipadd|DHCP]
   [MASK=ipadd] [METric=1..16]
   [MULticast={BOTH|OFF|ON|RECeive|SENd}]
   [OSPFmetric=1..65534|DEFAULT]
   [POLicyfilter={0..999|NONE}]
   [PRIorityfilter={0..999|NONE}]
   [PROxyarp={DEFRoute|False|LOCal|NO|OFF|ON|STrict|True|
   YES}] [RIPMetric=1..16] [SAMode={Block|Passthrough}]
   [VJC={False|NO|OFF|ON|True|YES}]
   [VLANPRiority={0..7|None}] [VLantag={1..4094|None}]
```

Description The new **local** option for **proxyarp** increases the range of ARP Requests that the router or switch responds to. When you specify **yes**, **on**, **true** or **strict**, the router or switch only responds to ARP Requests with a specific route if it exists, and ignores all others. When you specify **local**, the router or switch responds for routes it has a specific route to, and routes within its local subnet that would normally be IGMP redirected. By intercepting and responding to these local ARP Requests, the router or switch prevents hosts within the subnet from successfully using MAC address resolution to communicate directly with one another. Instead, traffic between hosts is forwarded through the router or switch.

show ddns

Syntax `SHow DDNS`

Description This command displays information about DDNS configuration and operation (Figure 6, Table 4 on page 42).

Figure 6: Example output from the **show ddns** command

```
DDNS Configure Information:
  Client State ..................... ENABLED
  Debug ............................ DISABLED
  Server ........................... members.dyndns.org
  Port ............................. 80
  User ............................. test
  Password ......................... ***
  system name ...................... dyndns
    hosts .......................... test.dyndns.org
                                     test.homeip.net
  system name ...................... dyndns
   hosts ........................... test.custom.dyndns.org
                                     test.custom.homeip.net
  MaileX ........................... alliedtelesis.co.nz
  Backmx ........................... no
  Wildcard ......................... off
  Offline .......................... no
  Primary WAN Interface ............ vlan1
  Secondary WAN Interface .......... none

DDNS Operation Information:
  Server IP ........................ 0.0.0.0
  IP in DynDns ..................... 202.49.72.10
  Current IP ....................... 202.49.72.10
Update failed - Suggested action:
  Config IP DNS or Set DDNS Serve
```

Table 4: Parameters in output of the **show ddns** command

Parameter	Meaning
Client State	Whether the DDNS feature is enabled.
Debug	The DDNS debug state.
Server	The DDNS server name.
Port	The TCP or UDP port number being used for the DDNS update. That is, the port that the packet is sent from.
system name	The DynDNS.com system that update messages use: either dyndns, statdns, or custom, depending on the type of hostname you chose. The router automatically sets the system name to an appropriate value for your hostname type.
hosts	A list of host names registered in this system, to be resolved to the router's public address.
MaileX	The name of the mail exchanger.
Backmx	Whether the MaileX is set as a backup mail exchanger.
Wildcard	Whether the wildcard (*) is used when matching host name.

Table 4: Parameters in output of the **show ddns** command (cont.)

Parameter	Meaning
Offline	Whether the hostnames are set to offline mode. Refer to the DynDNS website for offline redirection options, available at: http://www.dyndns.com/services/dns/dyndns/faq.html
Primary WAN Interface	The IP interface used for the main WAN connection.
Secondary WAN Interface	The IP interface used for the backup WAN connection.
Server IP	The IP address of Dynamic DNS server resolved by DNS.
IP in DynDns	The IP address assigned to the listed host names at the last update.
Current IP	The latest IP address assigned to local WAN connection.
Update Failed - Suggested action	User action to take if the last update failed.

show debug active

Syntax `SHow DEBug ACTIve={ALL|`*`module`*`}`

Description For IP debugging, this command now displays the value of the IP debugging timeout (Figure 7).

Figure 7: Example output from the **show debug active=ip** command

```
IP
 ------------------------------------------------------------
IP Debug Timeout: 30 seconds
IP Debug Options Enabled:
      IP Packet
      IP ARP
```

show ip interface

Syntax `SHow IP INTerface[=`*interface*`] [COUnter[=MULticast]]`

Description This command displays interface configuration information for interfaces assigned to the IP module with the **add ip interface** command. The new **GArp** field displays whether or not the interface accepts gratuitous ARPs. The **PArp** field now displays **Loc** when local proxy ARP is enabled on the interface.

Figure 8: Example output of the **show ip interface** command from an AT-8600 Series switch

```
Interface     Type     IP Address       Bc Fr PArp  Filt RIP Met.
Pri. Filt     Pol.Filt Network Mask     MTU   VJC   GRE  OSPF Met.  DBcast  Mul.
GArp
-------------------------------------------------------------------------------
LOCAL         -        Not Set          -  n  Def   ---  -          -       ---
---           ----     -                -     -     ---  -          -       ---
On
Loopback      192.168.10.100            -  n  -     ---  -          -       ---
---           ---      -                -     -     ---  -          -       ---
On
vlan2         Static   192.168.1.1      1  n  Loc   ---  01         Pass    No
---           ---      255.255.255.0    1500  -     ---  0000000001 No      Rec
On
vlan3#        Static   192.168.2.1      1  n  Loc   ---  01         Pass    No
---           ---      255.255.255.0    1500  -     ---  0000000001 No      Rec
Off
-------------------------------------------------------------------------------
```

Table 5: New and modified parameters in the output of the **show ip interface** command

Parameter	Meaning
PArp	Whether this interface supports proxy ARP and if ARP responses will be generated if a default route exists; one of "On" (respond to ARP Requests only if a specific route exists), "Loc" (responds to ARP Requests if a specific route exists, including ARP requests for hosts within a subnet) "Off", or "Def" (respond to ARP Requests if a specific route or a default route exists).
GArp	Whether the interface accepts or rejects gratuitous ARP messages; one of "On" or "Off".

DHCP Enhancements

This Software Version includes the following enhancement to DHCP:

- DHCP Options

This section describes the enhancement. The new and modified commands to implement it are described in Command Reference Updates.

DHCP Options

Software Version 2.9.1 introduces the ability to create user-defined DHCP options and apply them to policies.

DHCP allows the client to receive options from the DHCP server. Options describe the network configuration, and various services that are available on the network.

Previously, you could only add standard, pre-defined options to policies, using the **add dhcp policy** command. Now, you can also add user-defined options, using the new **add dhcp option** command.

Command Changes

The following table summarises the new and modified commands:

Command	Change
add dhcp option	New command
delete dhcp option	New command
set dhcp option	New command
show dhcp policy	New option values in display output

Command Reference Updates

This section describes each new command and the changed portions of modified commands and output screens. For modified commands and output, the new parameters, options, and fields are shown in bold.

add dhcp option

Syntax

```
ADD DHCP OPTion=number POLIcy=name [NAMe=option-name]
   TYpe={IP|SWItch|VALue|STRing|HexString|NONE}
   VALue=value
```

Description

This new command allows you to create a user-defined option for the specified policy. User-defined options are outside the standard range of pre-defined options that you can define using the **add dhcp policy** command.

It is possible to add a user-defined option with the same number as an existing pre-defined option. If this situation occurs, the user-defined option takes precedence - that is, it overrides but does not eliminate the pre-defined option.

Parameter	Description
OPTion	A number for the option. *number* is a decimal number between 1 and 254.
POLIcy	The name of the policy to add the option to. *name* is a character string 1 to 15 characters long. Any printable character is allowed. When you enter a *name* that contains spaces, you must surround it with double quotation marks.
NAMe	Use this optional parameter to define a name for the option. *option-name* is a character string 1 to 15 characters long. Any printable character is allowed. When you enter an *option-name* that contains spaces, you must surround it with double quotation marks.
TYpe	Use this optional parameter to specify a format in which to define the **value** parameter. Default: **none**

TYpe	Value format
IP	One or more IPV4 addresses in dotted decimal format, separated by commas.
SWItch	Any of: **on**, **off**, **yes**, **no**, **true**, **false**, **enabled**, **disabled**.
VALue	A decimal number between 0 and 4294967295.
STRing	A character string from 1 to 255 characters long. Any printable character is allowed. When you enter a string that contains spaces, you must surround the string with double quotation marks.
HexString	A string of 1 to 255 sets of hexadecimal character pairs; a maximum of 510 characters. The 510 character maximum includes any blank spaces or quotes used.
NONE	No value is required.

VALue	*value* is a user-defined value, which you must enter in the format specified with the **type** parameter - see above for details.

Examples To add option 151 to the "base" policy with the **name** "svpserver", and a **type** of **ip**, use the command:

```
add dhcp opt=151 poli=base nam=svpserver ty=ip
   val=192.168.3.3
```

To add option 114 to the "base" policy with no **name**, and a **type** of **string**, use the command:

```
add dhcp opt=114 poli=base ty=str
   val=http://allied-telesis.com
```

delete dhcp option

Syntax `DELete DHCP OPTion=`*`number`* `POLIcy=`*`name`*

Description This new command deletes a user-defined option from the specified policy. User-defined options are created with the **add dhcp option** command.

It is possible for the same option number to be specified for different options, one using **add dhcp option** and one using **add dhcp policy**. This command only deletes the option created with **add dhcp option**.

To completely delete the option number from the system, you must also delete the option with the same number that was created with **add dhcp policy**. You can do this using the **delete dhcp policy** command.

Once this option is deleted, any existing pre-defined option with the same option number becomes the active option.

Parameter	Description
OPTion	The number of the option to delete. This option must have been defined using **add dhcp option**. *number* is a decimal number between 1 and 254.
POLIcy	The name of the policy that the option is attached to. *name* is a character string 1 to 15 characters long. It may contain any printable character. When you enter a *name* that contains spaces, you must surround it with double quotation marks.

Example To delete option 151 from the "base" policy, use the command:

```
del dhcp opt=151 poli=base
```

set dhcp option

Syntax
```
SET DHCP OPTion=number POLIcy=name [NAMe=option-name]
   [TYpe={IP|SWItch|VALue|STRing|HexString|NONE}]
   [VALue=value]
```

Description This new command allows you to modify an existing user-defined option on the specified policy. User-defined options are created using **add dhcp option**.

You can modify the values set for the **name**, **type**, and **value** parameters. You cannot change the **policy** to which the option applies.

Parameter	Description
OPTion	The number of the user-defined option to modify. *number* is a decimal number between 1 and 254.
POLIcy	The policy to which the option applies. *name* is a character string 1 to 15 characters long. Any printable character is allowed. When you enter a *name* that contains spaces, you must surround it with double quotation marks.
NAMe	Use this optional parameter to set a new name for the option. *option-name* is a character string 1 to 15 characters long. Any printable character is allowed. When you enter an *option-name* that contains spaces, you must surround it with double quotation marks.
TYpe	Use this optional parameter to specify a format in which to define the **value** parameter. If you specify a **type**, the **value** parameter is mandatory. Default: **none**
VALue	*value* is a user-defined value, which you must enter in the format specified with the **type** parameter - see above for details. If you specify a **value**, the **type** parameter is mandatory.

TYpe	Value format
IP	One or more IPV4 addresses in dotted decimal format, separated by commas.
SWItch	Any of: **on**, **off**, **yes**, **no**, **true**, **false**, **enabled**, **disabled**.
VALue	A decimal number between 0 and 4294967295.
STRing	A character string from 1 to 255 characters long. Any printable character is allowed. When you enter a string that contains spaces, you must surround the string with double quotation marks.
HexString	A string of 1 to 255 sets of hexadecimal character pairs; a maximum of 510 characters. The 510 character maximum includes any blank spaces or quotes used.
NONE	No value is required.

Examples To set a new **name** of "server1" for option 151 on the "base" policy, use the command:

```
set dhcp opt=151 poli=base nam=server1
```

To change the IP address for the user-defined option 151 on the "base" policy to 192.168.3.2, use the command:

```
set dhcp opt=151 poli=base ty=ip value=192.168.3.2
```

show dhcp policy

Syntax `SHow DHCP POLIcy[=name]`

Description This command displays information about currently defined policies and the options configured for them. If you specify a policy *name*, then information about that policy is displayed only.

Figure 9: Example output from the **show dhcp policy** command

```
DHCP Policies

Name: pol1
  Base Policy: none
  01 subnetmask .... 255.255.255.0
  03 router ........ 202.36.163.21
  06 dnsserver ..... 192.168.100.50  192.168.100.33
  51 leasetime ..... 3600
*151 SVP server .... 192.168.88.20

Name: prnt
  Base Policy: pol1
  01 subnetmask .... (pol1) 255.255.255.0
  03 router ........ (pol1) 202.36.163.21
  06 dnsserver ..... (pol1) 192.168.100.50  192.168.100.33
  51 leasetime ..... (prnt) infinity
*151 SVP server .... (pol1) (none)
*161 ............... (prnt) 192.168.4.2 192.168.6.2
*172 privservernum...(prnt) 4
*253 optionpresent...(prnt) (none)
*254 privservernam15.(prnt) privateserver
```

Table 6: Modified parameters in the output of the **show dhcp policy** command

Parameter	Description
options...	A list of the options configured for the specified policy. Each entry includes the following information:
	The DHCP option identifier. This is the number that was assigned to the option. The number now has an asterisk (*) on its left if its option is a user-defined option, configured using the new **add dhcp option** command.
	The parameter keyword. This is now either: the default assigned name for an option between the numbers of 1-68 that was configured using **add dhcp policy**, or a name that was user-defined for the option using the new **add dhcp option** command.
	The current values of the option. If the option was configured using the new **add dhcp option** command then the option value is formatted based on the specified **type**.

Example To display information about the “base” policy, use the command:

```
sh dhcp poli=base
```

DHCP Snooping Enhancements

This Software Version includes the following enhancements to DHCP snooping:

- **Adding Default Access Routers to Static Entries**
- **Filtering Broadcast and Multicast Packets**

This section describes the enhancements. The new and modified commands to implement them are described in **Command Reference Updates**.

Adding Default Access Routers to Static Entries

You can now specify the access routers for a static entry. This allows DHCP snooping to create a static entry for use in conjunction with MAC-Forced Forwarding. To do this, use the **router** parameter in the command:

```
add dhcpsnooping binding[=macaddr] interface=vlan ip=ipadd
   port=port-number router=ipadd,ipadd...
```

Adding a MAC address to the static entry is no longer compulsory. Instead, the static entry is primarily identified by the IP address. For static DHCP entries without a MAC address defined, ARP security compares only the IP address details.

To delete a static entry, you must specify the IP address of the static entry using the new **ip** parameter in the command:

```
delete dhcpsnooping binding ip=ipadd
```

For more information about MAC-Forced Forwarding, see the *MAC-Forced Forwarding* chapter at the end of this Release Note.

Command Changes

The following table summarises the modified commands:

Command	Change
add dhcpsnooping binding	New **router** parameter Modified **binding** parameter
delete dhcpsnooping binding	New **ip** parameter

Filtering Broadcast and Multicast Packets

For AT-8600, AT-8700XL, AT-8800, and Rapier Series switches, you can now enhance DHCP snooping filtering so that the switch drops multicast and broadcast packets sent from a client, except for:

- ARP packets
- IGMP Replies and IGMP Leaves packets, when IGMP snooping is enabled
- DHCP packets, when DHCP snooping is enabled

To enable this filtering, use the command:

```
enable dhcpsnooping strictunicast
```

To disable strict unicast filtering, use the command:

```
disable dhcpsnooping strictunicast
```

For the AT-8948, x900-48, and AT-9900 Series switches, DHCP filtering works in conjunction with QoS and Classifiers. The **enable dhcpsnooping strictunicast** command causes the switch to drop IGMP packets sent from a client, except for IGMP Replies and IGMP Leaves packets when IGMP snooping is enabled.

To enable this filtering, use the command:

```
enable dhcpsnooping strictunicast
```

To filter other multicast and broadcast packets, and stop the switch's hardware from forwarding IGMP packets, you must configure QoS using the **create qos policy** command, and classifiers using the **create classifier** command.

To disable strict unicast filtering, use the command:

```
disable dhcpsnooping strictunicast
```

Command Changes

The following table summarises the new commands:

Command	Change
disable dhcpsnooping strictunicast	New command
disable dhcpsnooping strictunicast	New command

Command Reference Updates

This section describes each new command and the changed portions of modified commands and output screens. For modified commands and output, the new parameters, options, and fields are shown in bold.

add dhcpsnooping binding

Syntax `ADD DHCPSnooping` **`BINDing[=macaddr]`** `INTerface=vlan IP=ipadd POrt=port-number` **`[ROUter=ipadd,ipadd...]`**

Description This command adds a static entry to the DHCP snooping binding database. The new **router** parameter allows you to specify the default access routers for the static entry.

Parameter	Description
BINDing	The MAC address of the client. Specifying a MAC address is now optional.
ROUter	An optional comma separated list of IP addresses that gives the default access routers for this client. Use this parameter if adding a DHCP snooping binding for use in conjunction with MAC-Forced Forwarding.

Example To add a static DHCP snooping entry for a client with the IP address 192.168.12.101, on port 6 of vlan101, that has access to two access routers with the IP addresses 66.105.1.2 and 66.105.1.4, use the command:

```
add dhcps bind int=vlan101 ip=192.168.12.101 po=6
   rou=66.105.1.2,66.105.1.4
```

delete dhcpsnooping binding

Syntax `DELete DHCPSnooping BINDing` **`IP=ipadd`**

Description This command deletes a dynamic or static entry from the DHCP snooping binding database. The new **ip** parameter specifies the IP address of the database entry to delete, in dotted decimal notation. You no longer need to specify the MAC address of the static entry to delete it.

Example To delete a DHCP snooping entry for a client with the IP address 192.168.12.101, use the command:

```
del dhcps bind ip=192.168.12.101
```

disable dhcpsnooping strictunicast

Syntax `DISable DHCPSnooping STRictunicast`

Description This new command disables strict unicast filtering on DHCP snooping clients. To use this command, DHCP snooping must be disabled.

On AT-8600, AT-8700XL, AT-8800, and Rapier Series switches, this restarts normal forwarding of multicast and broadcast packets sent by clients to devices further upstream.

On AT-8948, x900-48, and AT-9900 Series switches, this restarts normal forwarding of IGMP packets sent by clients to devices further upstream. To fully disable strict unicast filtering, you must disable any configured QoS and classifiers dealing with IGMP packets that are attached to the untrusted ports.

Example To disable strict unicast filtering on DHCP snooping clients, use the command:

```
dis dhcps str
```

enable dhcpsnooping strictunicast

Syntax `ENable DHCPSnooping STRictunicast`

Description This new command enables strict unicast filtering on DHCP snooping clients. To use this command, DHCP snooping must be disabled.

When enabled on AT-8600, AT-8700XL, AT-8800, and Rapier Series switches, the switch drops multicast and broadcast packets sent from a client, except for:

- ARP packets
- IGMP Replies and IGMP Leaves packets, when IGMP snooping is enabled
- DHCP packets, when DHCP snooping is enabled

This ensures a client cannot flood other network devices using broadcast or multicast packets.

When enabled on AT-8948, x900-48, and AT-9900 Series switches, the switch drops IGMP packets, except for IGMP Replies and IGMP Leaves when IGMP snooping is enabled.

This ensures that a client cannot flood network devices using IGMP queries. Use this command in conjunction with QoS and Classifiers commands. To stop other broadcast and multicast packets, you must configure QoS using the **create qos policy** command, and classifiers using the **create classifier** command.

Example To enable strict unicast filtering on DHCP snooping clients, use the command:

```
en dhcps str
```

MAC-Forced Forwarding

This Software Version adds support for MAC-Forced Forwarding. MAC-Forced Forwarding provides a method for subscriber separation on a network. It is appropriate for IPv4 Ethernet based networks, where a layer 2 bridged segment separates downstream clients from their upstream IPv4 gateways. It offers:

- the ability to monitor, filter, and police any traffic between separate clients within the same subnet
- efficient use of limited resources
- greater security within the subnet

For information and command syntax, see the *MAC-Forced Forwarding* chapter found at the end of this document.

IP Multicasting Enhancements

This Software Version includes the following enhancements to IP Multicasting:

- PIM Support on AT-8600 Series Switches
- Query Solicitation

This section describes the enhancements. The new and modified commands to implement them are described in Command Reference Updates.

PIM Support on AT-8600 Series Switches

This Software Version introduces Protocol Independent Multicast (PIM) on the AT-8600 Series switches. For information about configuring PIM on your switch, see the *IP Multicasting* chapter at the end of this Release Note.

When running Software Version 2.9.1 on an AT-8600 Series switch, you will need a special feature licence to use PIM. Contact your authorised Allied Telesis distributor or reseller for details and passwords of feature licences.

Query Solicitation

This Software Version enhances IGMP snooping by providing the new query solicitation feature. Query solicitation minimises loss of multicast data after a topology change on networks that use EPSR or spanning tree (STP, RSTP, or MSTP) for loop protection.

When IGMP snooping is enabled and EPSR or Spanning Tree changes the underlying link layer topology, this can interrupt multicast data flow for a significant length of time. Query solicitation prevents this by monitoring for any topology changes. When it detects a change, it generates a special IGMP Leave message known as a Query Solicit, and floods the Query Solicit message to all ports in every VLAN that query solicitation is enabled on. When the IGMP Querier receives the message, it responds by sending a General Query, which all IGMP listeners respond to. This refreshes snooped group membership information in the network.

Query solicitation functions by default (without you enabling it) on all VLANs on the root bridge in an STP instance and on all data VLANs on the master node in an EPSR instance. By default, the root bridge or master node always sends a Query Solicit message when the topology changes.

If you have multiple STP or EPSR instances, query solicitation only sends Query Solicit messages on VLANs in the instance that experienced a topology change.

In switches other than the STP root bridge or EPSR master node, query solicitation is disabled by default, but you can enable it by using the command:

```
set igmpsnooping vlan={vlan-name|1..4094|all}
   querysolicit={on|yes|true}
```

If you enable query solicitation on a switch other than the STP root bridge or EPSR master node, both that switch and the root or master send a Query Solicit message.

Once the Querier receives the Query Solicit message, it sends out a General Query and waits for responses, which update the snooping information throughout the network. If necessary, you can reduce the time this takes by tuning the IGMP timers, especially the **queryresponseinterval** parameter. For more information, see the "IGMP Timers and Counters" section of *How To Configure IGMP on Allied Telesyn Routers and Switches for Multicasting*. This How To Note is available in the Resource Center of the Documentation and Tools CDROM for Software Version 2.8.1, or from www.alliedtelesis.co.uk/en-gb/solutions/techdocs.asp?area=howto

Disabling Query Solicitation and Display Settings

On switches other than the STP root bridge or EPSR master node, you can disable query solicitation by using the command:

```
set igmpsnooping vlan={vlan-name|1..4094|all}
   querysolicit={off|no|false}
```

To see whether query solicitation is on or off, use the command:

```
show igmpsnooping
```

Check the new Query Solicitation field.

Changes to IGMP Snooping Fast Leave Command Syntax

The command syntax for the Fast Leave feature has also been changed, to make it more like the syntax for the query solicitation feature.

To enable Fast Leave on a specific VLAN, or all VLANs on the switch, the new syntax is:

```
set igmpsnooping vlan={vlan-name|1..4094|all}
   fastleave={on|yes|true}
```

To disable Fast Leave on a specific VLAN, or all VLANs on the switch, the new syntax is:

```
set igmpsnooping vlan={vlan-name|1..4094|all}
   fastleave={off|no|false}
```

The original syntax was:

```
set igmpsnooping fastleave={on|yes|true|off|no|false}
   [interface=vlan]
```

This original syntax is still valid, but we recommend using the new syntax instead.

Command Changes

The following table summarises the new and modified commands:

Command	Change
set igmpsnooping vlan	New command
show igmpsnooping	New **Query Solicitation** field

Command Reference Updates

This section describes each new command and the changed portions of modified commands and output screens. For modified commands and output, the new parameters, options, and fields are shown in bold.

set igmpsnooping vlan

Syntax

```
SET IGMPSNooping VLAN={vlan-name|1..4094|ALL}
   [Fastleave={ON|OFF|YES|NO|True|False}]
   [QUErysolicit={OFF|NO|False|ON|YES|True}]
```

where *vlan-name is* a unique name from 1 to 32 characters. Valid characters are uppercase and lowercase letters, digits, the underscore, and hyphen. The *vlan-name* cannot be a number or **all**.

Description This command enables or disables Fast Leave processing and the new query solicitation feature for IGMP Snooping.

The **vlan** parameter specifies the VLAN on which the specified feature is to be enabled or disabled. The default is **all**.

The **fastleave** parameter specifies whether Fast Leave processing is enabled or disabled. If you specify **on**, **yes** or **true** then Fast Leave processing is enabled on the specified VLAN or all VLANs. If you specify **off**, **no** or **false** then Fast Leave processing is disabled on the specified VLAN or all VLANs. Note that Fast Leave should not be configured on a port that has multiple hosts attached because it may adversely affect multicast services to some hosts. The default is **off**.

This command deprecates the following command, which is still valid:

```
set igmpsnooping fastleave={on|yes|true|off|no|false}
   [interface=vlan]
```

The **querysolicit** parameter specifies whether query solicitation is enabled on the specified VLANs. Query solicitation minimises loss of multicast data after a topology change on networks that use EPSR or spanning tree (STP, RSTP, or MSTP) for loop protection. When an EPSR or STP topology change occurs, IGMP snooping sends a query solicit message out every VLAN that query solicitation is enabled on. When the IGMP Querier receives the message, it responds by sending a General Query, which all IGMP listeners respond to. This refreshes snooped group membership information in the network. The default is **on** for the root bridge in an STP topology and the master node in an EPSR topology and **off** for other routers or switches.

Example To enable IGMP Snooping Fast Leave processing on VLAN “vlan2”, use the command:

```
set igmpsn vlan=vlan2 f=on
```

show igmpsnooping

Syntax `SHow IGMPSNooping [VLAN={`*`vlan-name`*`|1..4094}]`

where *vlan-name* is a unique name for the VLAN 1 to 32 characters long. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen.

Description This command displays information about IGMP snooping on a VLAN or VLANs (Figure 10, Table 7). This now includes the status of query solicitation.

Figure 10: Example output from the **show igmpsnooping** command

```
IGMP Snooping
-------------------------------------------------------------
Status ........................... Enabled
Disabled All-groups ports ........ None

Vlan Name (vlan id) ..... default (1)
Fast Leave .............. On
Static Router Ports ..... None
Query Solicitation ...... Off
.
.
.
```

Table 7: New parameters in output of the **show igmpsnooping** command

Parameter	Meaning
Query Solicitation	Whether query solicitation is enabled on this VLAN.

OSPF Enhancements

This Software Version includes the following enhancement to OSPF:

- Neighbour Retransmission List Debugging

This section describes the enhancement. The modified commands to implement it are described in Command Reference Updates.

Neighbour Retransmission List Debugging

A new **nrl** debugging option has been added to OSPF, to show additions to and deletions from the neighbour retransmission list. To enable NRL debugging, use the command:

```
enable ospf debug=nrl
```

Note that this option may generate large amounts of debugging output on a large OSPF network. Use it with care.

To disable NRL debugging, use the command:

```
disable ospf debug=nrl
```

Command Changes

The following table summarises the modified commands:

Command	Change
disable ospf debug	New **nrl** option for **debug** parameter
enable ospf debug	New **nrl** option for **debug** parameter

Command Reference Updates

This section describes the changed portions of modified commands. The new options are shown in bold.

disable ospf debug

Syntax

```
DISable OSPF DEBug={ALL|AUTOcost|IFSTate|LSU|NBRSTate|
   NSSA|PACket|NRL|REDistribute|SPF|STAte}
```

Description The option **nrl** has been added to the **debug** parameter. If you specify **nrl**, neighbour retransmission list debugging is disabled.

enable ospf debug

Syntax

```
ENAble OSPF DEBug={ALL|AUTOcost|IFSTate|LSU|NBRSTate|
   NSSA|PACket|NRL|REDistribute|SPF|STAte}
   [TIMEOut={NONE|1..2400}]
```

Description The option **nrl** has been added to the **debug** parameter. If you specify **nrl**, the router or switch displays changes to the neighbour retransmission list. Note that this option may generate large amounts of debugging output on a large OSPF network. Use it with care.

BGP Enhancements

This Software Version includes the following enhancements to BGP:

- **Improved BGP Route Selection**
- **Improved BGP Backoff Show Command Output**

This section describes the enhancements. The modified commands to implement them are described in **Command Reference Updates**.

Improved BGP Route Selection

This Software Version changes the preference order that BGP uses when selecting a route based on the “route type” rule. The order of “route type” preference is now:

1. routes imported into the BGP routing table from the router’s RIB, using BGP import or network entries
2. routes learned through a BGP aggregate entry
3. routes learned from a foreign peer of any type, such as an EBGP, IBGP or confederation peer

Command Changes

This enhancement does not affect any commands.

Improved BGP Backoff Show Command Output

This Software Version includes the following improvements in the output of the **show bgp backoff** command:

- The output now has a field called "command status", which displays “disabled” if the backoff feature has been manually disabled, or “enabled” at all other times.
- The field “backOff state” now displays “peer disabled” if you have enabled BGP backoff but no peers yet exist.

Command Changes

The following table summarises the modified command:

Command	Change
show bgp backoff	New **command status** field
	Modified **backOff state** field

Command Reference Updates

This section describes the changed portions of modified output screens. The new fields are shown in bold.

show bgp backoff

Syntax `SHow BGP BACkoff`

Description This command displays BGP backoff details (Figure 11, Table 8).

Figure 11: Example output of the **show bgp backoff** command

```
BGP Backoff Stats:
 Stat                          Value
---------------------------------
command status              ENABLED
backOff state       PEER DISABLED
total hist backOffs              5
total backOffs                   0
total backOff Limit              0
consecutive backOffs             0
consecutive backOffs limit       5
base Timeout                    10
Timeout multiplier             100%
Timeout step                     1
Timeout length (sec)            10
Mem Upper Threshold Value       95%
Mem Upper Notify               TRUE
Mem Lower Threshold Value       90%
Mem Lower Notify              FALSE
Current Mem use                 84%
---------------------------------
```

Table 8: New and modified parameters in the output of the **show bgp backoff** command

Parameter	Meaning
command status	Overall status of the BGP backoff; either ENABLED or DISABLED.
backOff state	The current status of BGP backoff. NORMAL displays when BGP backoff is not active and BGP is processing normally. BACKED OFF displays when system memory use has reached its upper threshold and BGP processing is halted. PEER DISABLED displays when the consecutive or total backoff limits have been reached and the peers have been disabled. This also displays if BGP backoff is enabled, but no peer has yet been discovered. DISABLED displays when the user has disabled backoff functionality.

IPv6 Enhancements

This Software Version includes the following enhancements to IPv6:

- Setting a Metric for RIPv6
- Additional Show Command Filtering

This section describes the enhancements. The modified commands to implement them are described in Command Reference Updates.

Setting a Metric for RIPv6

A new **metric** parameter lets you specify the cost to RIPv6 for crossing the logical interface. This parameter is allowed only on link-local interfaces. Therefore, setting this parameter also sets the metrics for all logical interfaces over the same IPv6 interface to the same value.

To specify the cost to RIPv6 for crossing the logical interface, use the new **metric** parameter in either of the commands:

```
create ipv6 interface=interface metric=1..16 [other-options]
set ipv6 interface=interface metric=1..16 [other-options]
```

For more information about RIPv6, see the *Internet Protocol version 6 (IPv6)* chapter of your Software Reference.

Command Changes

The following table summarises the modified commands:

Command	Change
create ipv6 interface	New **metric** parameter
set ipv6 interface	New **metric** parameter

Additional Show Command Filtering

This Software Version includes the new **full** parameter for the command:

```
show ipv6 route [full]
```

The **show ipv6 route full** command displays all the routes in the IPv6 route table. In previous software versions, the **show ipv6 route** command displayed this. The **show ipv6 route** command now displays a subset of the routing table.

Command Changes

The following table summarises the modified command:

Command	Change
show ipv6 route	New **full** parameter

Command Reference Updates

This section describes the changed portions of the modified commands. The new parameters are shown in bold.

create ipv6 interface

Syntax

```
CREate IPV6 INTerface=interface [DUPtrans=1..16]
   [METric=1..16] [RETRans=0..4294967295]
```

Description This command creates an IPv6 Ethernet interface and uses stateless address autoconfiguration to assign it a link-local address.

The new **metric** parameter specifies the cost to RIPv6 for crossing the logical interface. This parameter is allowed only on link-local interfaces. Therefore, setting this parameter also sets metrics for all logical interfaces over the same IPv6 interface to the same value. The default is **1**.

set ipv6 interface

Syntax

```
SET IPV6 INTerface=interface [FILter=0..99]
   [IPaddress=ipv6add/prefix-length] [METric=1..16]
   [PREFerred=1..4294967295|INFinite]
   [PRIorityfilter=200..299]
   [PUBlish={YES|NO|ON|OFF|True|False}]
   [VALid=1..4294967295|INFinite]
```

Description This command modifies values associated with an interface that was created by either the **create ipv6 interface** or **add ipv6 interface** command.

The new **metric** parameter specifies the cost to RIPv6 for crossing the logical interface. This parameter is allowed only on link-local interfaces. Therefore, setting this parameter also sets the metrics for all logical interfaces over the same IPv6 interface to the same value. The default is **1**.

show ipv6 route

Syntax

```
SHow IPV6 ROUte [FULL]
```

Description This command displays the contents of the IPv6 route table. The **full** parameter displays all the routes in the IPv6 route table. When the **full** parameter is not specified, then the command displays a subset of the routing table that includes:

- all static routes
- all interface routes
- only the RIP routes that are alive and best

Firewall Enhancements

This Software Version includes the following enhancements to Firewall:

- Using Automatic Client Management to Manage SIP Sessions
- Setting a Trigger for Automatic Client Management
- Limiting Firewall Sessions from a Device
- Monitoring Firewall Sessions using SNMP
- Dynamic Renumbering of Firewall Rules

This section describes the enhancements. The new and modified commands to implement them are described in Command Reference Updates.

Using Automatic Client Management to Manage SIP Sessions

This Software Version allows you configure the SIP ALG to dynamically manage SIP clients using the new automatic client management mode.

Automatic client management mode allows the SIP ALG to dynamically manage SIP clients and reserve firewall sessions for registered SIP clients. The SIP ALG does this by monitoring the messages sent by private SIP clients to SIP Registrars, and creating sessions that match the registration details. The SIP ALG also provides NAT when this is configured on the firewall.

For a VoIP phone to send and receive calls, it must register on the wider network with a SIP Registrar. When a SIP client registers, the SIP Registrar sends a response back to the SIP client informing the client of the expiry time limit for the registration. The SIP ALG looks for these messages and records the expiry time. It then makes sure that the firewall session created is retained until the registration expires. This means that the client is reachable through the firewall with the registered IP address and port for the entire duration of the registration. This is different to normal firewall session behaviour, where sessions are timed out and deleted if no traffic is seen for a certain time period.

Once registered, a SIP client can send and receive calls through a SIP Proxy Server. Often the proxy server is on the same device as the SIP Registrar, and uses the same firewall session created for the SIP Registrar. However, SIP clients can send and receive calls from proxy servers that are independent from the SIP Registrar.

When a proxy server is initiating a call to a SIP client, it uses the client's IP address and port details listed with the SIP Registrar. If the proxy server is on a different device from the Registrar, and you have configured the SIP ALG client management to allow calls from unknown proxy servers, then the SIP ALG creates a new firewall session for the proxy server. This new session uses the same global IP and port translation for the client that the firewall has assigned for the Registrar session. When the client initiates a session with any independent proxy server, the SIP ALG can also assign to the new session the same global IP and port that the Registrar session has. This gives the client a consistent identity on the public network.

Note that a private device may use the same global IP address and port number to send registration messages for more than one SIP URI. If this occurs, then the SIP ALG keeps the session open until all the registrations have expired.

Network address translation

In automatic mode, the SIP ALG uses NAT on the sessions when NAT has been configured on the firewall. We recommend that you select enhanced NAT. In automatic mode, the SIP ALG is designed to give each SIP client a consistent identity on the public network when NAT is in use.

It is possible to use the SIP ALG without NAT. This is an option for networks where the SIP clients have globally routable IP addresses, or the whole SIP network is restricted to a privately addressed network.

Configuring the SIP ALG in automatic mode

This section describes how to configure the firewall so that VoIP calls are managed using the SIP ALG in automatic mode. This includes configuring enhanced NAT on the firewall policy.

Before you start

This section describes the IP and firewall configuration. You also need to:

- configure the underlying connection to the Internet, such as PPP or ADSL
- create a security officer and enable system security, if required

Procedure

Step	Action	Commands
1	Configure IP on the public and private interfaces: assign IP addresses create a default route on the public interface, if required	add ip interface=*interface* ipaddress=*ipadd* [*other-ip-parameters*] add ip route=0.0.0.0 mask=0.0.0.0 interface=*public-interface* nexthop=*ipadd*
2	Enable IP.	enable ip
3	Enable the SIP ALG.	enable firewall sipalg
4	Create a firewall policy.	create firewall policy=*name* [*other-policy-parameters*]
5	Use the policy on the router or switch's public and private interfaces.	add firewall policy=*name* interface=*public-interface* type=public add firewall policy=*name* interface=*private-interface* type=private
6	Configure the NAT mode for the policy.	add firewall policy=*name* nat=enhanced
7	Configure the SIP ALG for the firewall: assign the mode specify the maximum number of automatic clients specify how calls to and from Proxy Servers are dealt with	**set firewall sipalg** mode=automatic [maxautoclients=1..1000] [multiservers={outonly|off|on|yes}]
8	Enable the firewall.	enable firewall

Storing client information

In automatic mode, the SIP ALG stores the SIP client details in a client database. This database contains the registration expiry times as well as client information, and is stored both dynamically and statically. The dynamic version is stored on RAM, while a static copy is stored on flash. The static copy is designed to minimise any loss of service to SIP clients. If a router or switch restart or reboot occurs, then the SIP ALG can immediately restore the firewall sessions using the information in this file.

To show details about the flash file and the current client sessions that the SIP ALG has, use the commands:

```
show firewall sipalg autoclients[=session-number] [summary]
show firewall sipalg autoclients ip=ipadd[-ipadd] [summary]
```

To delete the current details in the client database, use the command:

```
reset firewall sipalg autoclients
```

Resetting the database does not delete any established SIP sessions.

In an AR400 or AR700 Series router with the flash autowrite feature disabled, the SIP ALG will not be able to create a static copy of the client database. To enable this feature, use the command:

```
enable flash autowrite
```

If you disable flash autowrite while the SIP ALG is in automatic mode, then the SIP ALG will no longer be able to write to the client database, but the file will still remain on the flash. To delete the file, use the command:

```
delete file=fwsipmap.sip
```

Command Changes

The following table summarises the new and modified commands:

Command	Change
reset firewall sipalg autoclients	New command
set firewall sipalg	New **mode** parameter New **maxautoclients** parameter New **multiservers** parameter
show firewall sipalg	New **Mode** field in output New **Maximum automatic clients** field in output New **Multiple servers** field in output
show firewall sipalg autoclients	New command

Setting a Trigger for Automatic Client Management

This Software Version allows you to set a firewall trigger to run a script when the SIP ALG reaches the limit for the number of SIP clients it can support in automatic mode. To create the trigger, use the new **sipautomax** parameter in the command:

```
create trigger=trigger-id firewall=sipautomax mode=start
    [other-options]
```

To modify the trigger, use the command:

```
set trigger=trigger-id firewall=sipautomax mode=start
    [other-options]
```

Command Changes

The following table summarises the modified commands:

Command	Change
create trigger	Modified **firewall** parameter
set trigger	Modified **firewall** parameter

Limiting Firewall Sessions from a Device

This Software Version allows you to limit the number of concurrent sessions a device can initiate by using the new **limitrule** firewall commands. Limit rules apply to firewall sessions initiated by a device on either side of the firewall, and are attached to policies.

Each time a device initiates a session through the firewall, the router or switch checks all the limit rules for the applicable firewall policy. If a session exceeds the limit in a matching rule, then the router or switch does not allow the new session to start. The device can only start the new session once it has ended one or more of the current sessions. If a session does not match any limit rules, then no limit is applied. Each policy can have up to 100 limit rules.

All matching existing session numbers are included when the router or switch checks the limit rules and more than one limit rule can apply to a session. However, if the firewall finds any matching rule that denies the session, then the session is denied, regardless of the other rules.

To add a limit rule to a policy, use the new **add firewall policy limitrule** command:

```
add firewall policy=policy-name limitrule=rule-id
   srciplimit=0..10000 [interface=interface]
   [gblremoteip=ipadd[-ipadd]] [ip=ipadd[-ipadd]]
```

The **ip** and **gblremoteip** parameters specify the IP address range of the private (**ip**) and public (**gblremoteip**) devices that you are limiting the sessions for. The limit is set with the **srciplimit** parameter, and is applied to each device separately. That is, if a rule limits devices to 20 sessions, then any device can initiate a maximum of 20 sessions regardless of the other devices' activity.

Each limit rule applies to sessions initiated from both sides of the firewall. For example, consider the command:

```
add firewall policy=policy-name limitrule=1 srclimit=3
   [interface=interface] gblremoteip=125.4.10.1-125.4.10.12
   ip=101.20.20.1
```

In the above example:

- the private device (101.20.20.1) can initiate a maximum of three sessions to all devices within the IP range 125.4.10.1 to 125.4.10.12
- each public device within the specified range can initiate up to three sessions each to the private device.

To modify a limit rule, use the new **set firewall policy limitrule** command:

```
set firewall policy=policy-name limitrule=rule-id
   [interface=interface] [gblremoteip=ipadd[-ipadd]]
   [ip=ipadd[-ipadd]] [srciplimit=0..10000]
```

These commands limit sessions only as they are created; new or modified limit rules do not end any sessions already established by a device.

To delete a limit rule, use the new **delete firewall policy limitrule** command:

```
delete firewall policy=policy-name limitrule=rule-id
```

To display the limit rules set for a policy, use the new **show firewall policy limitrule** command:

```
show firewall policy=policy-name
   limitrule[=rule-id[-rule-id]] [detail]
```

The **show firewall policy** command has also been modified to show a summary of the number of limit rules attached to a policy.

The firewall debugging feature has been enhanced to encompass the addition of limit rules to the firewall. The **enable firewall policy debug** and **disable firewall policy debug** commands now include the **limitrule** option for displaying debugging related to limit rules.

Command Changes

The following table summarises the new and modified commands:

Command	Change
add firewall policy limitrule	New command
delete firewall policy limitrule	New command
disable firewall policy debug	New **limitrule** option for **debug** parameter
enable firewall policy debug	New **limitrule** option for **debug** parameter
set firewall policy limitrule	New command
show firewall policy	New **Number of Limitrules** field
show firewall policy limitrule	New command

Monitoring Firewall Sessions using SNMP

This Software Version allows you to use SNMP to monitor these firewall session details:

- the total number of sessions through the firewall
- the number of current sessions that each private and public device has established through the firewall

To monitor the number of current sessions that individual devices are using, the firewall must generate a session report database. To enable the firewall to generate this database, use the command:

```
enable firewall sessionreport
```

Note that there is a resource cost for the router or switch to maintain this database, so session reporting is disabled by default.

To disable session reporting, use the command:

```
disable firewall sessionreport
```

The firewall Group of the Allied Telesis Enterprise MIB ({ enterprises(1) alliedTelesis(207) mibObject(8) brouterMib(4) atRouter(4) modules(4) 77 }), now includes firewallSessionsStatistics ({ firewall 2 }). This is a collection of objects for monitoring firewall sessions:

- totalNumberOfSessions ({ firewallSessionsStatistics 1 }) is the total number of sessions going through the firewall. It is the sum of the number of sessions on all individual nodes.
- numberOfSessionsPerNodeCountingStatus ({ firewallSessionsStatistics 2 }) is the status of counting the number of sessions per node - enabled(1) or disabled(2).
- numberOfSessionsPerNodeTable ({ firewallSessionsStatistics 3 }) is a table of nodes and number of sessions per node, indexed by IP address. It contains the following objects:
  - nodeIpAddress, the IP address of a node that has firewall limit rules attached and is being monitored.
  - numberOfSessionsPerNode, the number of active sessions created by the corresponding node.

Command Changes

The following table summarises the new and modified commands:

Command	Change
disable firewall sessionreport	New command
enable firewall sessionreport	New command
show firewall	New **SNMP Session Report** field

Dynamic Renumbering of Firewall Rules

This Software Version dynamically renumbers firewall rules, so that you can easily insert a new rule between two consecutive ones. For example, you can now insert a new rule 2 on a policy with rules numbered 1, 2, 3, 7. The new rule takes position 2 in the rule list, while the existing rule 2, and the rest of the rules with numbers greater than 2, are renumbered and shuffled down the rule list until a gap in the numbering scheme is found. The new rule list is numbered 1, 2, 3, 4, 7.

Note that the second instance of a particular rule number keeps that number, not the first instance. This means that if you add a sequence of rules where two rules have the same number, the first of these rules may become significantly lower on the list. For example, if a configuration script has these rule numbers in this sequence:

```
add firewall policy=policy-name rule=1
add firewall policy=policy-name rule=3
add firewall policy=policy-name rule=3
add firewall policy=policy-name rule=4
add firewall policy=policy-name rule=5
```

then the first instance of rule 3 is eventually renumbered until it becomes rule 6. This occurs because the second rule 3 becomes rule 3 and renumbers the first rule 3 to rule 4. Then the second rule 4 renumbers it to rule 5, and the second rule 5 renumbers it to rule 6. The new list of rule numbers is 1, 3, 4, 5, 6.

Command Changes

This enhancement does not affect any commands.

Command Reference Updates

This section describes each new command and the changed portions of modified commands and output screens. For modified commands and output, the new parameters, options, and fields are shown in bold.

add firewall policy limitrule

Syntax

```
ADD FIREwall POLIcy=policy-name LIMitrule=rule-id
   [INTerface={interface}] [IP=ipadd[-ipadd]]
   [GBLRemoteip=ipadd[-ipadd]] [SRCIplimit=0..10000]
```

Description

This command adds a limit rule to a firewall policy. Limit rules apply a limit to the number of concurrent sessions that a device can initiate through the firewall. Each firewall policy can have up to 100 limit rules. The details for a session must match all values set for the **interface**, **ip**, and **gblremote** parameters for the limit rule to apply.

Each time a device initiates a session across the firewall, the router or switch checks all the limit rules attached to a policy. If a session exceeds the limit in a matching rule, then the router or switch does not allow the new session to start. The device can only start the new session once it has ended one or more of the current sessions.

This command only applies the limit as sessions are created; it does not end any sessions established by the device before this rule was added. However, all matching existing session numbers are included when the router or switch checks the limit rules.

Parameter	Description
POLIcy	The policy that the rule is added to. The *policy-name* is a string 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits (0–9), and the underscore character. The specified policy must already exist.
LIMitrule	A numerical identifier for the rule for this policy. The *rule-id* is a decimal number from 1 to 4294967295.
INTerface	The interface that the rule is applied to. The interface must already exist and belong to the policy. Valid interfaces are: eth (such as eth0, eth0-1) VLAN (such as vlan1, vlan1-1) FR (such as fr0, fr0-1) X.25 (such as x25t0, x25t0-1) PPP (such as ppp0, ppp1-1) Alternatively, this may be a dynamic interface, formed by concatenating the string "dyn-" with the name of a dynamic interface template (e.g. dyn-remote). Default: all interfaces attached to the policy
IP	IP address of the private device or range of devices you are limiting the sessions for. Devices must be on the private side of the firewall. The IP address is specified using dotted decimal notation. Default: all private devices

Parameter	Description
GBLRemoteip	IP address of the public device or range of devices you are limiting the sessions for. Devices must be on the public side of the firewall. The IP address is specified using dotted decimal notation. Default: all public devices
SCRIplimit	Number of sessions matching this rule that each device is allowed. Default: **0** (no limit set)

Example To limit all devices on the interface vlan2 to a maximum of 12 active sessions per device, using the policy named "AT_Field", use the command:

```
add fire poli=AT_Field lim=1 int=vlan2 srci=12
```

create trigger

Syntax

```
CREate TRIGger=trigger-id
   FIREwall={ALL|DOSattack|FRAgattack|HOStscan|PORtscan|
   SESSION|SIPAutomax|SMTPATTACK|SMUrfattack|SYNattack|
   TCPattack} [MODE={STArt|END|BOTH}] [AFTer=hh:mm]
   [BEFore=hh:mm] [{DAte=date|DAYs=day-list}] [NAMe=name]
   [REPeat={Yes|No|ONCe|FOREver|count}]
   [SCript=filename...] [STAte={ENAbled|DIsabled}]
   [TEST={YES|NO|ON|OFF|True|False}]
```

Description This command creates a new trigger for the firewall and defines events and conditions that activate it.

Firewall Event	Description
SIPAutomax	This trigger activates when the SIP ALG reaches the limit for the number of SIP clients it can support in automatic mode. After this trigger is first activated, further triggers are rate limited to once every 20 minutes. The trigger will not activate again until at least 20 minutes have passed in which the limit is not exceeded. Note that the firewall policy and source IP address script parameters are not valid for this type of event. You can set the **mode** parameter only to **start** for this trigger.

Example To create trigger 6, which activates the script file fwsipmax.scp when the SIP ALG has reached the limit of SIP clients it is configured to support in automatic mode, use the command:

```
cre trig=6 fire=sipa mode=sta sc=fwsipmax.scp
```

delete firewall policy limitrule

Syntax `DELete FIREwall POLIcy=`*`policy-name`* `LIMitrule=`*`rule-id`*

Description This command deletes a limit rule from the specified policy.

Parameter	Description
POLIcy	The policy you are deleting the rule from. The *policy-name* is a string 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits (0–9), and the underscore character. The specified policy must already exist.
LIMitrule	The numerical identifier for the rule you are deleting. The *rule-id* is a decimal number from 1 to 4294967295.

Example To delete limit rule 1 from the policy named "EVA", use the command:

```
del fire poli=EVA lim=1
```

disable firewall policy debug

Syntax
```
DISable FIREwall POLIcy[=policy-name]
   DEBug={ALL|ARP|CHecksum|HTTP|IDentproxy|LIMitrule|
   PACKet|PKT|PRocess|PROXy|RADius|SIPAlg|SMTP|TCP|UPNP}
   [DEBUGMode={ALL|ERRORcode|MESSage|PARSing|TRAce}]
```

Description This command disables debugging of the specified policy or all policies. The new **limitrule** option for the **debug** parameter allows you stop the display of debugging information related to limit rules.

Example To stop displaying debugging of limit rules for all policies, use the command:

```
dis fire poli deb=lim
```

disable firewall sessionreport

Syntax `DISable FIREwall SESsionreport`

Description This command stops the firewall from maintaining a database of the number of firewall sessions that private and public devices use. SNMP reporting will no longer have access to this database. Note that the there is a resource cost for the router or switch to maintain this database, so session reporting is disabled by default.

Example To stop the firewall from maintaining the session report for SNMP, use the command:

```
dis fire ses
```

enable firewall policy debug

Syntax

```
ENable FIREwall POLIcy[=policy-name]
   DEBug={ALL|ARP|CHecksum|HTTP|IDentproxy|LIMitrule|
   PACKet|PKT|PRocess|PROXy|RADius|SIPAlg|SMTP|TCP|UPNP}
   [DEBUGMode={ALL|ERRORcode|MESSage|PARSing|TRAce}]
   IP=ipadd[-ipadd]
```

Description This command enables debugging of the specified policy or all policies. The new **limitrule** option for the **debug** parameter allows you to display debugging information related to limit rules.

Example To display debugging of limit rules for the “SEELE” policy, use the command:

```
en fire poli=SEELE deb=lim
```

enable firewall sessionreport

Syntax

```
ENAble FIREwall SESsionreport
```

Description This command enables the firewall to create a database that records individual firewall sessions for SNMP reporting. The database monitors the number of sessions created by private and public devices. Note that there is a resource cost for the router or switch to maintain this database, so session reporting is disabled by default.

Example To enable the firewall to create a session report that SNMP can access, use the command:

```
ena fire ses
```

reset firewall sipalg autoclients

Syntax

```
RESET FIREwall SIPAlg AUTOclients
```

Description This command deletes the SIP ALG’s current client database. The SIP ALG generates this database when it is in automatic client management mode. This command deletes both the dynamic version in RAM and the static version in flash memory. Established SIP sessions are not affected.

Note that you can delete single automatic sessions using the **delete firewall session** command. Use the **show firewall sipalg autoclients** command to determine the session number.

Example To reset the client details created by the SIP ALG in automatic mode, use the command:

```
reset fire sipa auto
```

set firewall policy limitrule

Syntax

```
SET FIREwall POLIcy=policy-name LIMitrule=rule-id
   [INTerface={interface}] [IP=ipadd[-ipadd]]
   [GBLRemoteip=ipadd[-ipadd]] [SRCIplimit=0..10000]
```

Description

This command modifies a limit rule attached to a firewall policy. Limit rules apply a limit to the number of concurrent sessions that a device can initiate through the firewall. Each firewall policy can have up to 100 limit rules. The details for a session must match all values set for the **interface**, **ip**, and **gblremote** parameters for the limit rule to apply.

Each time a device initiates a session across the firewall, the router or switch checks all the limit rules attached to a policy. If a session exceeds the limit in a matching rule, then the router or switch does not allow the new session to start. The device can only start the new session once it has ended one or more of the current sessions.

This command only applies the limit as sessions are created; it does not end any sessions established by a device before this rule was modified. However, all matching existing session numbers are included when the router or switch checks the limit rules.

Parameter	Description
POLIcy	The policy that the rule is added to. The *policy-name* is a string 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits (0–9), and the underscore character. The specified policy must already exist.
LIMitrule	A numerical identifier for the rule for this policy. The *rule-id* is a decimal number from 1 to 4294967295. The specified rule must already exist.
INTerface	The interface that the rule is attached to. The interface must already exist and belong to the policy. Valid interfaces are: eth (such as eth0, eth0-1) VLAN (such as vlan1, vlan1-1) FR (such as fr0, fr0-1) X.25 (such as x25t0, x25t0-1) PPP (such as ppp0, ppp1-1) Alternatively, the interface may be a dynamic interface, formed by concatenating the string "dyn-" with the name of a dynamic interface template (e.g. dyn-remote). Default: all interfaces attached to the policy
IP	IP address of the private device or range of devices you are limiting the sessions for. Devices must be on the private side of the firewall. The IP address is specified using dotted decimal notation. Default: all private devices
GBLRemoteip	IP address of a public device or range of devices you are limiting the sessions for. Devices must be on the public side of the firewall. The IP address is specified using dotted decimal notation. Default: all public devices
SCRIplimit	Number of sessions matching this rule that each device is allowed. Default: **0** (no limit set)

Example To modify limit rule 1 attached to vlan2 for the "Nerv_office" policy to match IP address 202.36.164.113, use the command:

```
set fire poli=Nerv_office lim=1 int=vlan2 ip=202.36.164.113
```

set firewall sipalg

Syntax

```
SET FIREwall SIPAlg
   [CALLIdtranslation={False|NO|OFF|ON|True|YES}]
   [MODe={MANual|AUTOmatic}] [MAXAutoclients=1..1000]
   [MULTIservers={OUTOnly|False|NO|OFF|ON|True|YES}]
```

Description This command modifies how the SIP ALG operates on the router or switch. The new **mode**, **maxautoclients** and **multiservers** parameters allow you to configure automatic client management for the SIP ALG.

Parameter	Description	
MODe	Whether the clients are managed automatically by the SIP ALG, or manually using policy rules. Default: **manual**	
	MANual	You must configure policy rules for each VoIP client to control their SIP sessions and provide NAT.
	AUTOmatic	The SIP ALG automatically manages firewall sessions for VoIP clients, and the firewall does not need policy rules configured for SIP traffic. The SIP ALG provides NAT for the clients by using the settings configured by the **add firewall policy nat** command. The recommended NAT setting is enhanced NAT.
MAXAutoclients	The maximum number of SIP clients that the SIP ALG will support when in automatic mode. Once the number of clients registered with firewall sessions reaches this maximum, registrations by other SIP clients are only permitted according to normal firewall behaviour or any configured firewall rules. These excess client's session details are not stored in flash memory, and will age out based on the configured **udptimeout** or **udpporttimeout** for the policy. This may interrupt SIP sessions for these clients. Take care not to set **maxautoclients** to a lower value than the current number of active clients registered, because this may interrupt the SIP sessions. This parameter is only valid when **mode** is set to **automatic**. Default: **100**	

Parameter (cont.)	**Description** (cont.)	
MULTIservers	How the SIP ALG interacts with sessions initiated to and from SIP Proxy Servers that are independent of the SIP Registrar. An independent proxy server does not have the same IP or port details as the SIP Registrar. This parameter is only valid when **mode** is set to **automatic**. Default: **no**	
	OUTOnly	Sessions sent by a SIP client to independent proxy servers are matched to the original session created between the SIP client and the SIP Registrar. If NAT is configured, then the translation is the same as the original session between the SIP client and the registrar. However, calls sent by proxy servers that do not have an existing session with the SIP client and do not have a matching allow rule are dropped.
	False, NO, OFF	A new firewall session is created for any calls to an independent proxy server that the SIP client makes. If NAT is configured, the translation does not match the original session created between the SIP client and the SIP Registrar. If no session currently exists between the proxy server and the SIP client and there is no matching allow rule for the server, any calls sent by the proxy server are dropped.
	ON, True, YES	Sessions sent and received from independent proxy servers are matched to the original session created between the SIP client and the SIP Registrar. If NAT is configured, then the translation is the same as the original session between the SIP client and the registrar. Calls from proxy servers that match the IP and port details the client has registered with the SIP Registrar are allowed through the firewall.

Example To enable the SIP ALG to automatically manage SIP clients on the private network, allowing a maximum of 50 SIP clients, use the command:

```
set fire sipa mod=auto maxa=50
```

set trigger

Syntax

```
SET TRIGger=trigger-id
   [FIREwall[={ALL|DOSattack|FRAgattack|HOStscan|PORtscan|
   SESSION|SIPAutomax|SMUrfattack|SYNattack|TCPattack}]]
   [MODE={STArt|END|BOTH}] [AFTer=hh:mm] [BEFore=hh:mm]
   [{DAte=date|DAYs=day-list}] [NAMe=name]
   [REPeat={Yes|No|ONCe|FOREver|count}]
   [TEST={YES|NO|ON|OFF|True|False}]
```

Description

This command modifies the definition of a trigger for the firewall and defines events and conditions that activate it.

Firewall Event	Description
SIPAutomax	This trigger activates when the SIP ALG reaches the limit for the number of SIP clients it can support in automatic mode. After this trigger is first activated, further triggers are rate limited to once every 20 minutes. The trigger will not activate again until at least 20 minutes have passed in which the limit is not exceeded. Note that the firewall policy and source IP address script parameters are not valid for this type of event. You can set the **mode** parameter only to **start** for this trigger.

show firewall

Syntax

```
SHow FIREwall
```

Description

This command displays a summary of all security policies that have been created and the interfaces assigned to each policy (Figure 12, Table 9). This now includes the status of SNMP session reporting.

Figure 12: Example output from the **show firewall** command

```
Firewall Configuration

Status ..................... enabled
Enabled Notify Options .... all
Notify Port ............... 1
Notify Mail To ............ root@netman.company.com
SNMP Session Report ....... disabled
Maximum Packet Fragments .. 20
Sessions:
  Maximum ................. 4000
  Peak .................... 2589
  Active .................. 400
.
.
.
```

Table 9: New parameters in the output of the **show firewall** command

Parameter	Meaning
SNMP Session Report	Status of SNMP session reporting; either enabled or disabled.

show firewall policy

Syntax

```
SHow FIREwall POLIcy[=policy-name] [COUnter]
   [RUle=rule-id[-rule-id]] [SUMmary]
```

Description

This command displays detailed information about the specified policy or all policies. It now includes a field summarising the number of limit rules configured for each policy (Figure 13, Table 10).

Figure 13: Example output from the **show firewall policy** command for a policy that has limit rules

```
Policy : Office
  TCP Timeout (s) ..................... 3600
  UDP Timeout (s) ..................... 1200
  Other Timeout (s) ................... 1200
  ICMP Unreachable Timeout (s) ...... 0
  TCP Handshake Timeout Mode ........ Normal
  MAC Cache Timeout (m) ............. 1440
  RADIUS Limit ....................... 100
  Accounting ......................... disabled
  Enabled Logging Options ........... none
  Enabled Debug Options ............. none
  Enabled Debug Modes ............... none
  Enabled Debug IP Address .......... none
  Identification Protocol Proxy ..... enabled
  Enabled IP options ................ none
  Enhanced Fragment Handling ........ none
  Enabled ICMP forwarding ........... none
  Receive of ICMP PINGS ............. enabled
  Number of Notifications ........... 1
  Number of Deny Events ............. 28
  Number of Allow Events ............ 172
  Number of Active TCP Opens ........ 3
  Number of Active Sessions ......... 31
  Cache Hits ........................ 812
  Discarded ICMP Packets ............ 19
  SMTP Domain ....................... not set
  FTP Data Port ..................... RFC enforced
  TCP Setup Proxy ................... enabled
  Number of Limitrules .............. 2
  .
  .
  .
```

Table 10: New parameters in the output of the **show firewall** command

Parameter	Meaning
Number of Limitrules	The number of limit rules configured for the policy.

show firewall policy limitrule

Syntax

```
SHow FIREwall POLIcy=policy-name
   LIMitrule[=rule-id[-rule-id]] [DETail]
```

Description

This command displays detailed information about the specified or all limit rules for the specified policies (Figure 14, Table 11 on page 82).

Parameter	Description
POLIcy	Name of the policy you wish to see the limit rule information for.
LIMitrule	Limit rule or range of limit rules to display. In no *rule-id* is specified, all limit rules for the policy are shown.
DETail	Displays a list of the devices that have active sessions matching the limit rule, and the number of sessions the device has active (Figure 15 on page 82, Table 11 on page 82).

Figure 14: Example output from the **show firewall policy limitrule** command

```
Policy=AT_Field
-------------------------------------------------------------

  Limitrule 1
-------------------------------------------------------------
    Interface ................... vlan2
    IP .......................... all
    GBL Remote IP ............... all
    Source IP Limit ............. 12

  Limitrule 2
-------------------------------------------------------------
    Interface ................... all
    IP .......................... all
    GBL Remote IP ............... all
    Source IP Limit ............. 30
```

Figure 15: Example output from the **show firewall policy limitrule detail** command

```
Policy=Nerv_office
-------------------------------------------------------------

  Limitrule 1
-------------------------------------------------------------
    Interface ................... vlan1
    IP .......................... 202.36.164.113
    GBL Remote IP ............... all
    Source IP Limit ............. 1
-------------------------------------------------------------
      Per Source IP Count
      Source IP Address          Active Sessions
      202.36.164.113 ............ 1
-------------------------------------------------------------

  Limitrule 2
-------------------------------------------------------------
    Interface ................... all
    IP .......................... all
    GBL Remote IP ............... all
    Source IP Limit ............. 12
-------------------------------------------------------------
      Per Source IP Count
      Source IP Address          Active Sessions
      101.111.12.13 ............. 5
      101.111.12.1 .............. 12
      202.36.164.113 ............ 1
```

Table 11: Parameters in output of the **show firewall limitrule detail** command

Parameter	Meaning
Policy	Name of the policy that the limit rules apply to.
Limitrule	Rule identification number for the limit rule.
Interface	Interface that the rule applies to.
IP	IP address or address range of the private devices that sessions are limited for.
GBL Remote IP	IP address or address range of the public devices that sessions are limited for.
Source IP Limit	Maximum number of active sessions matching this limit rule that a device can have.
Per Source IP Count	Summary of any current matching sessions a device has for the limit rule.
Source IP Address	IP address of the device that initiated the session.
Active Sessions	Current number of active session initiated by the device.

Example To display the configuration of limit rule 1 of firewall policy “Nerv_ office”, use the command:

```
sh fire poli=Nerv_office lim=1
```

show firewall sipalg

Syntax

```
SHow FIREwall SIPAlg

SHow FIREwall SIPAlg IP=ipadd[-ipadd]

SHow FIREwall SIPAlg CALLId=call-id

SHow FIREwall SIPAlg SUMmary
```

Description This command displays summary or detailed information for active SIP sessions using the SIP ALG on the router or switch (Figure 16, Table 12 on page 83).

Parameter	Description
IP	Displays only the active sessions related to a specified IP address or range. This now includes fields summarising the SIP ALG's automatic client management mode configuration.
CALLId	Displays only the active session with the specified Call-ID. This now includes fields summarising the SIP ALG's automatic client management mode configuration.
SUMmary	Displays summary information for all the active sessions on the router or switch. This now includes fields summarising the SIP ALG's automatic client management mode configuration.

Figure 16: Example output from the **show firewall sipalg** command

```
SIP ALG Configuration
  Status ..................... Enabled
  Mode ....................... Automatic
  Maximum automatic clients .... 50
  Multiple servers ............. No
  Call-ID translation .......... Enabled

Active SIP Sessions
------------------------------------------------------------
.
.
.
```

Table 12: New parameters in output of the **show firewall sipalg** command

Parameter	Meaning
Mode	Whether the SIP ALG is in "automatic" or "manual" client management mode.
Maximum automatic clients	Maximum number of clients that the SIP ALG is configured to support when the SIP ALG is in automatic client management mode.
Multiple servers	How the SIP ALG interacts with sessions initiated to and from SIP Proxy Servers that are independent of the SIP Registrar when the SIP ALG is in automatic client management mode. One of "Yes", "No" and "Outonly".

show firewall sipalg autoclients

Syntax

```
SHow FIREwall SIPAlg AUTOclients[=session-number]
   [SUMmary]

SHow FIREwall SIPAlg AUTOclients IP=ipadd[-ipadd]
   [SUMmary]
```

Description

This command displays the client database details collected by the SIP ALG when in automatic client management mode (Figure 17, Table 13 on page 85).

Parameter	Description
AUTOclients	Displays the client database details. The *session-number* is an identifier assigned to an active SIP session and, if specified, only the details for that session are displayed. Specifying a session number is not valid when the **ip** parameter is specified.
IP	Displays only the active sessions related to a specified IP address or range. This matches to the source address for private devices only. You can specify either a single IP address, or an IP address range, in dotted decimal notation. Specifying the **ip** parameter is not valid when a session number is specified with the **autoclients** parameter. Default: no default
SUMmary	Displays summary information for all the active sessions on the firewall. If a session number or the **ip** parameter is specified, then the summary details are filtered according to those parameters (Figure 18 on page 85, Table 13 on page 85).

Figure 17: Example output from the **show firewall sipalg autoclients** command

```
SIP ALG Automatic Clients
-------------------------------------------------------------
  Automatic client file ........ fwsipalg.sip
    Number of clients .......... 2
    Last updated ............... 10:11:55 4-Jul-2006
    Update pending ............. No
  Active clients
    Number of active clients ... 2
    Last updated ............... 12:38:23 4-Jul-2006

Active Automatic Clients
-------------------------------------------------------------
  Session number ............... 2131
  SIP client IP:Port ........... 192.168.1.2:5060
  Gbl IP:Gbl port .............. 20.20.20.89:22984
  SIP registrar IP:Port ........ 20.20.20.88:5060
  First registration time ...... 10:04:24 4-Jul-2006
  Seconds to expiry ............ 2436
  Session number ............... 2fbc
  SIP client IP:Port ........... 192.168.1.3:5060
  Gbl IP:Gbl port .............. 20.20.20.89:4132
  SIP registrar IP:Port ........ 20.20.20.88:5060
  First registration time ...... 10:11:44 4-Jul-2006
  Seconds to expiry ............ 3214
-------------------------------------------------------------
```

Figure 18: Example output from the **show firewall sipalg autoclients summary** command

```
SIP ALG Automatic Clients
-------------------------------------------------------------------------------
  Automatic client file ........ fwsipalg.sip
    Number of clients .......... 2
    Last updated ............... 10:11:55 4-Jul-2006
    Update pending ............. No
  Active clients
    Number of active clients ... 2
    Last updated ............... 12:38:23 4-Jul-2006

Active Automatic Clients
-------------------------------------------------------------------------------
Session      SIP client IP:Port.   Gbl IP:Gbl port.      SIP registrar
-------------------------------------------------------------------------------
2131         192.168.1.2:5060      20.20.20.89:22984     20.20.20.88:5060
9fbc         192.168.1.3:5060      20.20.20.89:4132      20.20.20.88:5060
-------------------------------------------------------------------------------
```

Table 13: Parameters in the output of the **show firewall sipalg autoclients** command

Parameter	Meaning
Automatic client file	Name of the client database file saved on flash memory. This static version of the database allows the SIP ALG to recover client sessions in case of a router or switch restart or reboot.
Number of clients	Number of clients stored in the file on flash memory.
Last updated	Time and date of the last update to the file on flash memory. This file is updated regularly from the dynamic client database stored on RAM.
Update pending	Whether the file on flash needs updating. "Yes" indicates that the dynamic version has changed, and the static version is scheduled to be updated. "No" indicates that the dynamic and static versions of the database are identical and there is no need for the router or switch to update the static version.
Active clients	Details about the clients the SIP ALG has listed in its client database. This includes any SIP client currently registered with a SIP Registrar as well as clients with calls in progress.
Number of active clients	Number of active SIP clients. This number is obtained from the dynamic version of the client database, so if an update is pending this number may be different from the number of clients listed for the static version of the database.
Last updated	Time and date of the last event that changed the client database details.
Session number, Session	An identifier for the session assigned by the firewall.
SIP client IP:Port	Private IP address and UDP source port used by the client.
Gbl IP:Gbl port	Public IP address and UDP port that the SIP ALG has assigned to the client, when NAT is configured.
SIP registrar IP:Port, SIP registrar	IP address of the SIP Registrar that the client has registered with. The port is the UDP port for SIP.

Table 13: Parameters in the output of the **show firewall sipalg autoclients** command

Parameter	Meaning
First registration time	Time and date that the client first registered with the SIP Registrar using this session. The same session is used each time the SIP client re-registers with the SIP Registrar, unless the session expires. The session should not expire unless the client does not re-register with the SIP Registrar within the expiry time limit set by the registrar.
Seconds to expiry	Time remaining until the client's existing registration expires with the SIP Registrar. The session is deleted if the client does not re-register before this time runs out.

Example To display information about every SIP client currently managed by the SIP ALG, use the command:

```
sh fire sipa auto
```

IP Security (IPsec) Enhancements

This Software Version includes the following enhancements to IPsec:

- **Additional RFC and Draft Compliance for NAT-T**
- **Increase to Maximum Number of IPsec SA Bundles**
- **Improved Debugging Options for IPsec and ISAKMP**
- **Improved Output for IPsec and ISAKMP Counters**
- **Modified Expiry Timeout Limit for Security Associations**

This section describes the enhancements. The modified commands to implement them are described in **Command Reference Updates**.

Additional RFC and Draft Compliance for NAT-T

NAT-T is now compliant with the following RFC and IETF Internet Drafts:

- RFC 3947 *Negotiation of NAT-Traversal in the IKE*
- draft-ietf-ipsec-nat-t-ike-03, *Negotiation of NAT-Traversal in the IKE*, which describes the modifications to IKE to support NAT detection and UDP tunnel negotiation
- draft-ietf-ipsec-udp-encaps-03, *UDP Encapsulation of IPsec Packets*, which defines the method of UDP encapsulation of IPSec packets

This is in addition to the pre-existing support for these Internet Drafts:

- draft-ietf-ipsec-nat-t-ike-02, *Negotiation of NAT-Traversal in the IKE*
- draft-ietf-ipsec-udp-encaps-02, *UDP Encapsulation of IPsec Packets*
- draft-ietf-ipsec-nat-t-ike-08, *Negotiation of NAT-Traversal in the IKE*
- draft-ietf-ipsec-udp-encaps-08, *UDP Encapsulation of IPsec Packets*

Command Changes

This enhancement does not affect any commands.

Increase to Maximum Number of IPsec SA Bundles

This Software Version increases the maximum number of concurrent IPsec Security Association bundles that each policy is allowed. The new limit is 100 concurrent bundles per policy. This enables IPsec to support up to 100 hosts using the same traffic selectors. This is valuable for networks that support roaming hosts, where minimal traffic selector information is known ahead of time.

Command Changes

This enhancement does not affect any commands.

Improved Debugging Options for IPsec and ISAKMP

This Software Version allows you to use the **show debug** command to execute a specific sequence of **show** commands useful for debugging IPsec and ISAKMP. Use the command:

```
show debug ipsec
```

If you need to contact your authorised distributor or reseller regarding an ISAKMP or IPsec problem, please include the output from the **show debug ipsec** command, as well as any output you have captured from ISAKMP or IPsec debugging. You will need to login to the router or switch as a security officer to produce all the available show outputs.

Command Changes

The following table summarises the modified command:

Command	Change
show debug	New **ipsec** parameter

Improved Output for IPsec and ISAKMP Counters

This Software Version includes additional output parameters, useful for monitoring IPsec and ISAKMP activity, for these commands:

```
show ipsec policy counter
```

```
show isakmp counters
```

Command Changes

The following table summarises the modified commands:

Command	Change
show ipsec policy counter	New **outBundleNotFound** field New **outNoBundleSqos** field
show isakmp counters	New **unexpectedMessage** fields

Modified Expiry Timeout Limit for Security Associations

This Software Version changes the maximum amount of kilobytes of data that Security Associations (SAs) in a bundle can process before the bundle expires and must be renegotiated. The maximum value you can set for **expirykbytes** is now **4193280** in the command:

```
create ipsec bundlespecification=bundlespecification-id
   keymanagement=isakmp string="bundle-string"
   [expirykbytes=1..4193280] [expiryseconds=300..31449600]
```

```
set ipsec bundlespecification=bundlespecification-id
   [expirykbytes=1..4193280] [expiryseconds=300..31449600]
```

The default for **expirykbytes** is now **4193280**.

Command Changes

The following table summarises the modified commands:

Command	Change
create ipsec bundlespecification	Modified **expirykbytes** parameter
set ipsec bundlespecification	Modified **expirykbytes** parameter

Command Reference Updates

This section describes the changed portions of modified commands and output screens. The new parameters, options, and fields are shown in bold.

create ipsec bundlespecification

Syntax

```
CREate IPSec BUNDlespecification=bundlespecification-id
   KEYmanagement={ISakmp|MAnual} STRING="bundle-string"
   [EXPIRYKbytes=1..4193280] [EXPIRYSeconds=300..31449600]
```

Description This command creates a bundle specification with the specified identification number in the IPsec Security Policy Database (SPD). The maximum value you can set for **expirykbytes** is now **4193280**.

set ipsec bundlespecification

Syntax

```
SET IPSec BUNDlespecification=bundlespecification-id
   [EXPIRYKbytes=1..4193280] [EXPIRYSeconds=300..31449600]
```

Description This command modifies the bundle specification with the specified identification number in the IPsec Security Policy Database (SPD). The maximum value you can set for **expirykbytes** is now **4193280**.

show debug

Syntax `SHow DEBug [STAck|FULl|IPSec]`

Description This command executes a specific sequence of **show** commands to produce output useful for debugging. The new **ipsec** parameter runs specific commands useful for debugging IPsec or ISAKMP problems.

Note that output depends on the router or switch's mode and user privilege as indicated in the following table.

Commands for show debug ipsec

‡ show system (with current config file)
show file
show install
‡ show feature
show release
‡ show config dynamic
show buffer scan
show cpu
show log
show exception
show ipsec policy sabundle
§ show ipsec sa=*sa*
show ipsec sa counters
show ipsec counters
¶ show ipsec policy=*policy* counters
show enco
show enco channel
† show enco channel=*channel*
† show enco channel=*channel* counters
show enco counters
show isakmp sa
show isakmp exchange
show isakmp exchange detail
show isakmp sa detail
show isakmp counters
show ffile check

‡ When the router or switch is in security mode, this command produces output only when the user has security officer privilege.

§ Selects all current IPsec SAs.

¶ Selects all IPsec policies configured with **action=ipsec**.

† Selects all ENCO channels in use.

show ipsec policy counter

Syntax `SHow IPSec POLIcy[=name] COUnter`

Description This command displays the counters for IPsec policies. The output of this command includes two new fields (Figure 19, Table 14).

Figure 19: Example output from the **show ipsec policy counter** command

```
Setup/Remove Counters:
  setupStarted                1   setupSaSetupFailImm        0
  setupSaSetupStarted         1   setupSaSetupFailed         0
  setupDone                   1   setupFailed                0
  removeStarted               0   removeSaSetupStarted       0
  removeDone                  0

Outbound Packet Processing Counters:
  outDeny                     0   outPermit                  0
  outNoBundle                 1   outNoBundleFail            0
  outMakeSetupStrctFail       0   outSetupBundleFail         0
  outBundleSoftExpire         0   outBundleExpire            0
  outProcessStart          4373   outProcessFailImm          0
  outBundleStateBad           0   outProcessFail             0
  outProcessDone           4373   outBundleNotFound          0
  outNoBundleSqos             0
  .
  .
  .
```

Table 14: New parameters in the output of the **show ipsec policy counter** command

Parameter	Meaning
outNoBundleSqos	Number of outbound packets discarded because the bundle was not found after SQoS processed the packet, and IPsec was unable to process the packet using another bundle. This can indicate that IPsec has removed a bundle suddenly, such as when the bundle reaches its **expirykbytes** limit.
outBundleNotFound	Number of outbound packets where the bundle was not found after SQoS processed the packet. This can indicate that IPsec has removed a bundle suddenly, such as when the bundle reaches its **expirykbytes** limit.

show isakmp counters

Syntax

```
SHow ISAkmp
   COUnters[={AGGressive|GENeral|HEArtbeat|INFo|IPSec|
   MAIn|NETwork|QUIck|SAD|SPD|TRAnsaction|XDB}]
```

Description This command displays all information counters for ISAKMP, or one or more categories of ISAKMP counters. The output displayed when you specify the **quick** parameter includes new fields (Figure 20, Table 15).

Figure 20: Example output from the **show isakmp counter=quick** command

```
Quick Mode Counters:
    .
    .
    .
  Error Counters: Initiator: General errors:

    initHash2Fail                   0     initDHGenFail                 0
    initStartCBFailed               0     initStartCBNoXchg             0
    initProc1CBFailed               0     initProc1CBNoXchg             0
    initHash4Fail                   1     unexpectedMessage             0
    .
    .
    .
                  Responder: General errors:

    respAcquireNoPolicy             0     respRemotePropNoMatch         0
    respHash1Fail                   0     respHash3Fail                 0
    respProc2CBFailed               0     respProc2CBNoXchg             0
    respProc3CBFailed               0     respProc3CBNoXchg             0
    unexpectedMessage               0
    .
    .
    .
```

Table 15: New parameters in the output of the **show isakmp counter=quick** command

Parameter	Meaning
unexpectedMessage	Number of times the router or switch received an unexpected message during a Quick mode exchange.

Link Layer Discovery Protocol

This Software Version adds support for the Link Layer Discovery Protocol (LLDP).

LLDP is a neighbour discovery protocol. Neighbour discovery protocols define standard methods for Ethernet network devices, such as switches and routers, to receive and transmit device-related information to other directly connected devices on the network, and to store the information that is learned about other devices in an LLDP defined MIB.

For more information and command syntax, see the *Link Layer Discovery Protocol* chapter at the end of this document.

Management Stacking Enhancements

This Software Version includes the following enhancement to Stacking:

- Changes to Local Commands

This section describes the enhancement.

Changes to Local Commands

When several switches are managed as a stack, a few commands are local commands—they relate only to the switch on which you type them, and not to any other switch in the stack. The switch's handling of such commands has been improved in the following ways:

- Local commands now cannot be host directed. If you try to enter a local command as a host directed command, the switch displays an error message.
- The command **show config dynamic** is now a local command.
- The command **disable stack** now cannot be run from a script.

Command Changes

This enhancement did not change any command syntax.

IP Multicasting

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set pim rpcandidate 83
show igmp filter 84
show igmpsnooping 86
show igmpsnooping counter 88
show igmpsnooping routeraddress 90
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Introduction

This chapter describes IP multicasting and support for multicasting on the switch.

Most IP packets are sent to a single host—unicast transmission—or to all hosts on a network or subnetwork – broadcast transmission. Multicasting is an alternative where packets are sent to a group of hosts simultaneously on a network or sub-network. Multicasting is also known as *group transmission*.

A multicast environment consists of senders (IP hosts), routers and switches (intermediate forwarding devices) and receivers (IP hosts). A multicast group has a class D IP address (the first number in the IP address – the top four bits – are 1110). Any IP host can send packets to a multicast group, in the same way that they send unicast packets to a particular IP host, by specifying its IP address. A host need not belong to a multicast group in order to send to it. Packets sent to a group address are only received by members of the group.

The switch uses the Internet Group Management Protocol (IGMP) to track multicast group membership, and one or more of the following protocols to route multicast traffic:

- Protocol Independent Multicast Sparse Mode (PIM-SM)
- Protocol Independent Multicast Dense Mode (PIM-DM)

PIM Sparse Mode, and PIM Dense Mode must be enabled with a special feature licence. To obtain one, contact an Allied Telesis authorised distributor or reseller.

The switch uses the Internet Group Management Protocol (IGMP) to track multicast group membership. For simple networks, the switch can be configured to use IGMP proxy for multicast switching between VLANs. For networks with an Ethernet ring topology, the switch can use Multicast VLAN Registration (MVR) to route between VLANs.

The multicast routing protocols described in this chapter are dynamic and respond to changes in multicast group membership. Interfaces on the switch can instead be configured statically to send and/or receive multicast packets. Static multicasting is described in "Static Multicast Forwarding" in the *Internet Protocol (IP)* chapter of your Software Reference.

References

Internet Draft *Protocol Independent Multicast - Sparse Mode (PIM-SM): Protocol Specification (Revised)*, Internet Engineering Task Force, PIM WG, 1 March 2002 (draft-ietf-pim-sm-v2-new-05).

Internet Draft *Protocol Independent Multicast - Dense Mode (PIM-DM): Protocol Specification (Revised)*, Internet Engineering Task Force, PIM WG, 15 February 2002 (draft-ietf-pim-dm-new-v2-01).

RFC 2236, *Internet Group Management Protocol, version 2*.

RFC 2715, *Interoperability Rules for Multicast Routing Protocols*.

IP Multicast Routing

For multicasting to succeed, the switch needs to know which of its interfaces are directly connected to members of each multicast group. To establish this, the switch uses IGMP for multicast group management (see "Internet Group Management Protocol (IGMP)" on page 17).

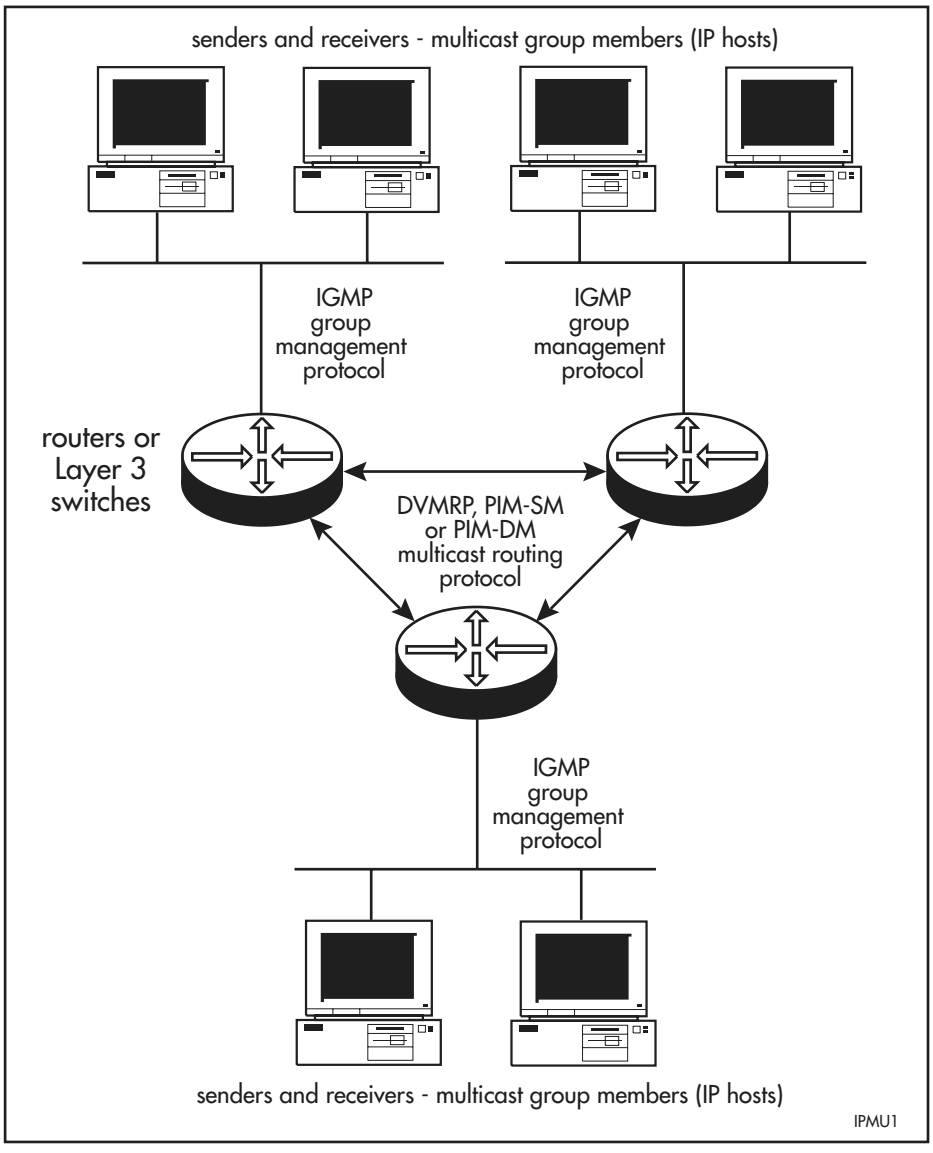
The switch must also know where to send multicast traffic. The switch maintains a routing table for multicast traffic with the following:

- PIM-Sparse Mode or PIM-Dense Mode

IGMP and one of the multicast routing protocols must be configured before the switch can forward multicast packets.

The relationships between IP hosts, routers, and multicasting protocols are shown in the following figure.

Figure 1: Multicast environment


senders and receivers - multicast group members (IP hosts)
IGMP group management protocol
IGMP group management protocol
routers or Layer 3 switches
DVMRP, PIM-SM or PIM-DM multicast routing protocol
IGMP group management protocol
senders and receivers - multicast group members (IP hosts)
IPMU1

When the switch finds out from IGMP that a new host has joined a multicast group on one of its interfaces, the switch needs to receive the multicast traffic for this group, so that it can forward it to the host. The switch uses the multicast routing protocol (PIM-SM or PIM-DM) to notify routers closer to the sender (upstream) to forward it traffic for the group. Routers running a multicast routing protocol, such as Protocol-Independent Multicast (PIM), maintain forwarding tables to forward multicast packets. PIM Sparse Mode and PIM Dense Mode share a multicast forwarding table.

Interoperability between Multicast Routing Protocols

The switch can be configured as a Multicast Border Router (MBR), as specified in RFC 2715, *Interoperability Rules for Multicast Routing Protocols.* A Multicast Border Router forms the border between two or more multicasting domains that are running different multicast routing protocols (PIM-SM or PIM-DM). The MBR forwards multicast packets across the different domains so that receivers in one domain can receive packets from sources in another domain. Therefore different interfaces on the switch can be configured as PIM-SM or PIM-DM interfaces.

The switch treats sources that are reached via another multicasting domain as if they were directly connected sources.

The IP configuration of an interface cannot be changed while PIM is attached to the interface. The PIM interface must first be deleted, and then re-added after the IP changes have been made.

Protocol Independent Multicast (PIM)

The two Protocol Independent Multicast routing protocols rely on the presence of an existing unicast routing protocol to adapt to topology changes, but are independent of the mechanisms of the specific unicast routing protocol.

Mode	Description
PIM Dense Mode	Suitable for networks where bandwidth is plentiful, and where members of a multicast group are densely distributed on the network.
PIM Sparse Mode	Suitable when members of the multicast groups are more sparsely distributed over the network because it results in less duplication of data packets over the network.

PIM Sparse Mode and PIM Dense Mode must be enabled with a special feature licence. To obtain one, contact an Allied Telesis authorised distributor or reseller.

The switch can be configured as a Multicast Border Router, with different interfaces connecting to multicast domains that use different multicast routing protocols. Therefore, some PIM interfaces can be configured for PIM-SM and others for PIM-DM. Multicast packets are forwarded between the Sparse Mode and Dense Mode domains as required.

PIM Dense Mode

Unlike PIM Sparse Mode, PIM Dense Mode (PIM-DM) does not use a designated router, bootstrap router, or rendezvous points.

PIM-DM employs the Reverse Path Multicasting (RPM) algorithm. When operating:

- PIM-DM relies on the presence of an existing unicast routing protocol to provide routing table information to build up information for the multicast forwarding database, but it is independent of the mechanisms of the specific unicast routing protocol.
- PIM-DM forwards multicast traffic on all downstream interfaces until explicit prune (un-join) messages are received. PIM-DM is willing to accept the overhead of broadcast-and-prune in the interests of simplicity and flexibility, and of eliminating routing protocol dependencies.

PIM-DM assumes that when a source starts sending, all downstream systems want to receive multicast datagrams. Initially, multicast datagrams are flooded to all areas of the network. If some areas of the network do not have group members, dense-mode PIM prunes the forwarding branch by setting up prune state. The prune state has an associated timer, which on expiration turns into forward state, allowing data to go down the branch that was previously in prune state.

The prune state contains source and group address information. When a new member appears in a pruned area, a router can “graft” toward the source for the group, turning the pruned branch into a forwarding branch. The forwarding branches form a tree rooted at the source leading to all members of the group. This tree is called a source rooted tree.

The broadcast of datagrams followed by pruning of unwanted branches is often referred to as a broadcast-and-prune cycle, typical of dense mode

protocols. The broadcast-and-prune mechanism in PIM Dense Mode uses a technique called *reverse path forwarding* (RPF), in which a multicast datagram is forwarded only when the receiving interface is the one used to forward unicast datagrams to the source of the datagram.

Configuring PIM Dense Mode

PIM multicasting routing is disabled by default and must be enabled on the switch before any PIM configuration takes effect. However, we recommend that the PIM configuration be completely set up on the switch before PIM is enabled. To enable or disable PIM, use the commands:

```
enable pim

disable pim
```

For PIM Dense Mode multicast routing to operate on the switch, each interface over which it is to send and receive multicast routing messages and multicast packets must be assigned to PIM-DM.

By default PIM interfaces are set to use Sparse Mode when they are added. To add a PIM-DM interface, use the command:

```
add pim interface=interface mode=dense [other-options...]
```

To delete an interface, use the command:

```
delete pim interface=interface
```

The IP configuration of an interface cannot be changed while PIM is attached to the interface. The PIM interface must first be deleted, and then re-added after the IP changes have been made.

To modify a PIM interface, use the command:

```
set pim interface=interface [mode={dense|sparse}]
    [other-options...]
```

State Refresh messages can be used in a PIM-DM domain to reduce unnecessary multicast traffic. Instead of a source repeatedly flooding downstream routers with multicast packets and repeatedly receiving prune messages, a State Refresh message maintains an existing prune. By default the switch cannot initiate or process State Refresh messages. To enable this functionality on an interface, use one of the commands:

```
add pim interface=interface mode=dense srcapable=yes
    [other-options...]

set pim interface=interface srcapable=yes [other-options...]
```

To restart all PIM processes on an interface, resetting the PIM timers, route information and counters for the interface, use the command:

```
reset pim interface=interface
```

To display information about PIM interfaces, use the command:

```
show pim interface
```

General PIM-DM information

The following commands display general PIM-DM information.

This command...	Shows...
show pim config	CLI commands that make up the switch's PIM configuration.
show pim counters	the number of PIM messages that the switch has received and sent, and the number of bad messages it has received.
show pim neighbour	information about the neighbouring switches that PIM is aware of.
show pim route	the internal PIM routing table.
show pim staterefresh	the internal State Refresh table.

PIM-DM timers

Timers for PIM-DM operations have defaults that suit most networks and should not generally be modified.

Caution Changing these timers to inappropriate values can cause PIM to function in undesirable ways. System administrators should change these timer values based on a sound understanding of their interaction with other devices in the network.

If the timers need to be modified, use the command:

```
set pim [jpinterval={1..65535|default}]
    [keepalivetime={10..65535|default}]
    [pruneholdtime={1..65535|default}]
    [sourcealivetime={10..65535|default}]
    [srinterval={10..255|default}] [other-options...]
```

To list the values of the global PIM timers, use the command:

```
show pim timer
```

PIM-DM debugging

To display debugging information about PIM-DM, use the command:

```
enable pim debug={all|assert|bsr|c-rp-adv|graft|hello|joint|
    register|staterefresh}[,...]
```

To see which debugging options are enabled, use the command:

```
show pim debug
```

PIM Sparse Mode

PIM Sparse Mode (PIM-SM) provides efficient communication between members of sparsely distributed groups - the type of groups that are most common in wide-area internetworks. It is designed on the principle that several hosts wishing to participate in a multicast conference does not justify flooding the entire internetwork with periodic multicast traffic. PIM-SM is designed to limit multicast traffic so that only those routers interested in receiving traffic for a particular group receive the traffic.

The switch supports PIM Sparse Mode as specified in Internet Draft *Protocol Independent Multicast - Sparse Mode (PIM-SM): Protocol Specification (Revised)*, 1 March 2002 (draft-ietf-pim-sm-v2-new-05).Routers with directly attached or downstream members are required to join a Sparse Mode distribution tree by transmitting explicit join messages. If a router does not become part of the predefined distribution tree, it does not receive multicast traffic addressed to the group. In contrast, dense mode multicast routing protocols assume downstream group membership and continue to forward multicast traffic on downstream links until explicit prune messages are received. The default forwarding action of a sparse mode multicast routing protocol is to block traffic unless it is explicitly requested, while the default action of the dense mode multicast routing protocols is to forward traffic.

PIM-SM employs the concept of a rendezvous point (RP) where receivers "meet" sources. The initiator of each multicast group selects a primary RP and a small ordered set of alternative RPs, known as the RP-list. For each multicast group, there is only a single active RP. Each receiver wishing to join a multicast group contacts its directly attached router, which in turn joins the multicast distribution tree by sending an explicit join message to the group's primary RP. A source uses the RP to announce its presence and to find a path to members that have joined the group. This model requires Sparse Mode routers to maintain some state information (the RP-list) prior to the arrival of data packets. In contrast, Dense Mode multicast routing protocols are data driven, since they do not define any state for a multicast group until the first data packet arrives.

Roles in PIM Sparse Mode

A multicast sender does not need to know the addresses of the members of the group in order to send to them, and the members of the group need not know the address of the sender. Group membership can change at any time. When PIM is enabled on the switch, and before the switch can route multicast traffic, it must establish which of the PIM routers in the network are performing some key roles: *designated router* (DR), *rendezvous point* (RP), and *bootstrap router* (BSR).

Designated router

There must be one PIM designated router (DR) in the subnetwork to which the IP hosts are connected. Any PIM-SM interfaces on the subnetwork elect the designated router with the highest DR priority. If there is more than one router with the same priority, or no priority, they choose the interface with the highest IP address number. The DR performs all the PIM functionality for the subnetwork. If the current DR becomes unavailable, the remaining routers elect a new DR on the interface by DR priority or IP address.

Rendezvous point

Each multicast group must have a rendezvous point (RP). The RP forms the root of the group's distribution tree. The designated router for a multicast sender sends multicast packets towards the RP. Designated routers with group members connected to them send join messages towards the group's RP. The RP candidate with the lowest priority is elected from all the RP candidates for a group. If the RP becomes unavailable, the remaining RP candidates elect a new RP.

Note that software release versions prior to 2.7.3 did not correctly support the PIM hash mask length option. As a result, the RP selection calculation differs between this release and release versions prior to 2.7.3. If a network contains switches running a mixture of versions, this leads to incorrect forwarding behaviour. To avoid this issue, either ensure that all devices on the network correctly support the hash mask length option (recommended), or ensure that the following **both** hold:

- The hash mask length option on all BSR candidates is configured to 4 bits. This implies that all BSR candidates must be running 2.7.3 or later.
- All RP candidates use a common prefix of 224.0.0.0/240.0.0.0. This has the side effect of collapsing all groups to use a single PIM RP.

Bootstrap router

Each PIM-SM network must have at least one bootstrap router (BSR) candidate, unless all routers in the domain are configured statically with information about all RPs in the domain. Every router that is a BSR candidate periodically sends a Bootstrap Candidate Advertisement message to advertise that it is available as a bootstrap router candidate. The BSR candidates in the network elect the router with the highest preference value to be the bootstrap router. The elected bootstrap router listens to PIM Candidate RP Advertisement messages specifying RP candidates for multicast groups. It maintains a list of RP candidates, and sends a bootstrap message every BSM interval, specifying all the multicast groups in the PIM network, and their rendezvous point candidates. Each router uses this information and a standardised hash mechanism to determine the RP for each group.

In summary:

- Each *multicast group* must have at least one rendezvous point candidate
- Each *PIM-SM domain* must have at least one Bootstrap Router candidate, unless all routers in the domain are configured statically with information about all RPs in the domain
- Each *subnetwork* must have at least one Designated Router candidate.

PIM hello messages

When PIM is enabled on a switch, it sends out a PIM *Hello* message on all its PIM enabled interfaces, and listens for Hello messages from its PIM neighbours. When a switch receives a Hello message, it records the interface, IP address, priority for becoming a designated router, and the timeout for the neighbour's information. The switch sends Hello messages regularly at the Hello Time interval.

Operation of PIM Sparse Mode

Once roles are established, multicast routing follows specific phases:

1. **Rendezvous point tree**
2. **Register stop**
3. **Shortest path tree**

While multicast routing always begins with phase 1, the designated router for a receiver determines whether and when to move on to phases 2 and 3, depending on the amount of traffic from the source.

Rendezvous point tree

Phase 1 establishes and uses a shared tree rooted at the rendezvous point (RP) to forward all multicast data to group members.

When an IP host sends an IGMP join message to the local PIM designated router, which is not the RP for the group, the designated router sends a *PIM join* message towards the RP for the group ("upstream"). The designated router determines which router is the RP for the group from the most recent bootstrap message. Every router the join message passes through records that there is a group member on the incoming interface. Eventually, the join message reaches either the RP, or another router that already knows that it has a group member downstream. If the group has many members, the join messages converge on the RP to form a rendezvous point tree (RPT). This is called a shared tree because multicast data that is sent to the group by any sender shares the tree. The multicast receiver's designated router sends join messages periodically according to the upstream join timer as long as the IP host is a member of the group. When the last receiver on a subnetwork leaves the group, the join messages stop, and their entries timeout on routers that are closer to the RP.

The sender's designated router encapsulates the multicast data in a unicast packet in a process called *registering*, and sends these register packets to the group's RP. When the RP receives the data, it decapsulates them, and forwards them onto the shared tree.

Register stop

Phase 2 improves efficiency and performance by using register stop. In this phase the RP joins the shortest path tree between the source and receiver. This allows the original (unencapsulated) packets to be forwarded from the sender, instead of encapsulated packets. It also allows shorter paths to receivers that are close to the sender, making it more efficient in some circumstances.

When the RP for a group receives the first encapsulated data packet from a source, it joins the shortest path tree towards the sender. Once data is able to flow along the shortest path from the sender to the RP, packets do not need to be registered. The RP sends a *register stop* message in reply to the next encapsulated message. When the sender's DR receives the register stop message, it stops registering. The DR sends a *null register* message to the RP to find whether the RP still does not need to receive registered packets. If it receives another register stop message, the DR continues to forward only the native data packets. If the DR does not receive another register stop message within the register probe time, it resumes registering the data packets and sending them to the RP.

When the RP starts receiving native data packets from the source, it starts to discard the encapsulated packets, and starts forwarding native packets on the shared tree to all the group members. If the path from the source to the RP intersects the shared RP tree for the group, then the packets also take a short-cut onto the shared tree for delivery to the group members down its branches.

Shortest path tree

This phase further optimises routing by using shortest path trees (SPT). In phase 3 the receiver joins the shortest path tree between the source and receiver. This allows a multicast group member to receive multicast data by the shortest path from the sender, instead of from the shared RP tree. When the receiver's DR receives multicast data from a particular sender, it sends a *join* message towards the sender. When this message reaches the sender's DR, the DR starts forwarding the multicast data directly towards the receiver. As several receivers all initiate shortest paths to the sender, these paths converge, creating a shortest path tree.

When the multicast packets start arriving from the SPT at the receiver's DR or an upstream router common to the SPT and the RPT, it starts discarding the packets from the RPT, and sends a *prune* message towards the RP. The prune message travels up the RPT until it reaches the RP or a router that still needs to forward multicast packets from this sender to other receivers. Every time a router receives a prune message, it waits a short time (the J/P Override Interval specified in Internet Draft draft-ietf-pim-sm-v2-new-05) before putting the prune into effect, so that other routers on the LAN have the opportunity to override the prune message.

Multi-Access LANs

If the PIM-SM network includes multi-access LAN links for transit, as well as point-to-point links, then a mechanism is needed to prevent multiple trees forwarding the same data to the same group member. Two or more routers on a LAN may have different information about how to reach the RP or the multicast sender. They could each send a join message to two different routers closer to the RP for an RPT or the sender for an SPT. This could potentially cause two copies of all the multicast traffic towards the receiver.

When PIM routers notice duplicate data packets on the LAN, they elect a single router to forward the data packets, by each sending PIM *Assert* messages. If one of the upstream routers is on an SPT and the other is on an RPT, the router on the SPT has the shortest path to the sender, and wins the Assert election. If both routers are on RPTs the router with the shortest path to the RP (the lowest sum of metrics to the RP) wins the Assert. If both routers are on an SPT, then the router with the shortest path to the sender (the lowest sum of metrics to the sender's DR) wins the Assert.

The router that won the Assert election forwards these data packets, and acts as the local designated router for any IGMP members on the LAN. The downstream routers on the LAN also receive the Assert messages, and send all their join messages to the Assert winner. The result of an Assert election times out after the Assert Time specified in the Internet Draft draft-ietf-pim-sm-v2-new-05. As long as the situation causing the duplication remains unchanged, the Assert winner sends an Assert message at a the Assert time interval, before the previous Assert messages time out. When the last downstream router leaves the SPT, the Assert winner sends an Assert Cancel message saying that it is about to stop forwarding data on the SPT. Any RPT downstream routers then switch back to the RP tree.

Configuring PIM Sparse Mode

PIM multicasting routing is disabled by default and must be enabled on the switch before PIM configuration takes effect. However, we recommend that the PIM configuration be completely set up on the switch before PIM is enabled. To enable or disable PIM, use the commands:

```
enable pim
disable pim
```

For PIM Sparse Mode multicast routing to operate on the switch, each interface over which it is to send and receive multicast routing messages and multicast packets must be assigned to PIM-SM. Each subnetwork must also have at least one designated router candidate, each network must have at least one bootstrap router candidate, and each multicast group must have at least one rendezvous point candidate.

The IP configuration of an interface cannot be changed while PIM is attached to the interface. The PIM interface must first be deleted, and then added again after the IP changes have been made.

PIM-SM interfaces

By default PIM interfaces are set to use Sparse Mode when they are added. To add a PIM-SM interface, use the command:

```
add pim interface=interface [drpriority=0..4294967295]
    [electby={drpriority|ipaddress}] [mode=sparse]
    [other-options...]
```

Each PIM-SM interface has a priority for becoming the designated router (DR) for its subnetwork. The higher the number, the higher the priority. The default designated router priority is 1. If the multicast group must choose a DR from interfaces with the same priority, or no priority, the interface with the highest IP address number is chosen.

The **electby** parameter determines how the switch elects the designated router for this interface. If **drpriority** is specified, the interface transmits its DR priority in its hello messages. If all routers in the subnetwork transmit their DR priorities, routers in the subnetwork can elect the DR by priority. If **ipaddress** is specified, the switch does not transmit its DR priority, which forces the routers in the subnetwork to elect the DR by IP address. The default is **drpriority**.

To delete an interface, use the command:

```
delete pim interface=interface
```

To modify the mode, designated router priority, or method by which the designated router is elected for a PIM interface, use the command:

```
set pim interface=interface mode={dense|sparse}
    [drpriority=0..4294967295] [electby={drpriority|
    ipaddress}] [other-options...]
```

To restart all PIM processes on an interface, resetting the PIM timers, route information and counters for the interface, use the command:

```
reset pim interface=interface
```

To display information about PIM interfaces, use the command:

```
show pim interface
```

Bootstrap router candidates

Each network of PIM–SM routers must have a bootstrap router (BSR). Each PIM–SM connected network must have at least one bootstrap router candidate. The candidate with the highest preference value becomes the bootstrap router. The default preference is 1. The bootstrap router sends a bootstrap message to other PIM–SM routers, containing a list of the RP candidates for multicast groups at BSM interval seconds. To designate the switch as a bootstrap router candidate, use the command:

```
add pim bsrcandidate [preference=0..255]
```

To change the switch's preference of bootstrap router candidate, use the command:

```
set pim bsrcandidate preference=0..255
```

To stop the switch from being as a bootstrap router candidate, use the command:

```
delete pim bsrcandidate
```

To display information about the switch's bootstrap router configuration, use the command:

```
show pim bsrcandidate
```

Rendezvous point

Each multicast group must have a rendezvous point (RP), which is either chosen dynamically from the list of rendezvous point candidates available or is statically configured on each router that processes traffic for that group. For dynamic RP selection, there must be at least one RP candidate in the PIM-SM connected network, but generally there should be several. PIM-SM chooses the RP candidate with lowest preference value to be the RP for the multicast group. The lower the number, the higher its priority. The default priority is 192. The dynamically-chosen RP advertises itself to the current bootstrap router at an interval specified by the **advinterval** parameter in the **set pim** command. The default **advinterval** is 60 seconds.

When an IP host joins a multicast group on a router, the router sends a *join* message to the active rendezvous point. The rendezvous point then knows to send multicast packets for the group to this router. When the last IP host leaves a group, the router sends a *prune* message to the RP, telling it that it no longer needs to receive multicast packets for the group.

To configure the switch to be a dynamic RP candidate, use the command:

```
add pim rpcandidate group=group-address [mask=ipaddress]
   [priority=0..255]
```

To modify the switch's RP candidate priority, use the command:

```
set pim rpcandidate group=ipadd [mask=ipadd] priority=0..255
```

The switch has the same values for **priority** for all multicast groups for which it is a rendezvous point candidate, so changing the priority for one group changes it for all groups.

To stop the switch from being an RP candidate, use the command:

```
delete pim rpcandidate group=group-address [mask=ipadd]
```

Static RP mappings can be configured instead of using the bootstrap mechanism. To configure a static rendezvous point on the switch for a multicast group, specify the IP address of the rendezvous point by using the command:

```
add pim rpcandidate=rp-address group=group-address
    [mask=ipaddress]
```

where *rp-address* is the IP address of the router that is the rendezvous point for the multicast group(s) specified. An RP can be statically configured as the RP for multiple groups, but each group can only have one statically-configured RP. Each router in the PIM-SM domain must be configured with the same static RP to group mapping.

Note that if the bootstrap mechanism is also running, a static RP mapping takes precedence.

To delete a static RP, use the command:

```
delete pim rpcandidate=rp-address group=group-address
    [mask=ipaddress]
```

To display information about multicast groups for which the switch is a rendezvous point candidate, use the command:

```
show pim rpcandidate
```

To display the static group-to-RP mapping followed by the elected bootstrap router's current set of RP candidates and the groups they are configured for, use the command:

```
show pim rpset
```

General PIM-SM information

The following commands display general PIM-SM information.

This command ...	Shows ...
show pim config	CLI commands that make up the switch's PIM configuration.
show pim counters	the number of PIM messages that the switch has received and sent, and the number of bad messages it has received.
show pim neighbour	information about the neighbouring switches that PIM is aware of.
show pim route	the internal PIM routing table.

PIM-SM timers

Timers for PIM-SM operations have defaults that suit most networks. However, if you need to modify them, use the command:

```
set pim[advinterval={10..15000|default}]
    [bsminterval={10..15000|default}] [jpinterval={1..65535|
    default}] [keepalivetime={10..65535|default}]
    [probetime={1..65535|default}]
    [suppressiontime={1..65535|default}] [other-options...]
```

Caution Changing these timers to inappropriate values can cause PIM to function in undesirable ways. System administrators should change these timer values based on a sound understanding of their interaction with other devices in the network.

To list the values of the global PIM timers, use the command:

```
show pim timer
```

PIM-SM debugging

To display debugging information about PIM-SM, use the command:

```
enable pim debug={all|assert|bsr|c-rp-adv|hello|join|
   register}[,...]
```

To see which debugging options are enabled, use the command:

```
show pim debug
```

Logging and SNMP Traps for PIM Sparse Mode

PIM-SM can be configured to produce log messages in response to status changes and errors, and SNMP traps. This feature does not apply to PIM-DM.

Status messages

Events that trigger a status-change log message are:

- PIM interface is disabled
- PIM interface is enabled
- PIM neighbour adjacency has timed out
- PIM neighbour generation ID has changed
- PIM neighbour has changed port
- PIM RP has changed
- PIM DR has changed
- PIM BSR has changed

Error messages

Errors that trigger a log message are:

- Invalid PIM packet
- Invalid destination address
- Fragmentation reassembly
- Packet too short
- Bad group address encoding
- Bad source address encoding
- Missing option
- Internal error
- Receive packet—a range of errors that mean the packet was received but cannot be forwarded.

SNMP traps

This trap is generated ...	When ...
PimInterfaceUpTrap	a PIM interface comes up and is active.
PimInterfaceDownTrap	a PIM interface goes down and is inactive.
PimNeighbourLossTrap	a known PIM neighbour has lost adjacency or has timed-out. This trap is part of the experimental PIM MIBs group.
PimNeighbourAddedTrap	a PIM neighbour is added.
PimNeighbourDeletedTrap	a PIM neighbour is deleted.
PimErrorTrap	any one of the PIM error counters is incremented or when a log message of subtype LOG_STY_PIM_ERROR is generated (see list of errors above).

To specify the type of log messages and SNMP traps that the switch generates, use the command:

```
set pim log={none|status|error|all}
    [trap={none|status|error|all}]
```

To display the specified options, use the command:

```
show pim debug
```

Internet Group Management Protocol (IGMP)

IGMP is a protocol used between hosts and multicast routers and switches on a single physical network to establish hosts' membership in particular multicast groups. Multicast routers use this information, in conjunction with a multicast routing protocol, to support IP multicast forwarding across the Internet.

The switch supports Internet Group Management Protocol version 2 (IGMPv2), defined in RFC 2236, I*nternet group Management Protocol, version 2*. It can also detect and interoperate with hosts and other designated routers (sometimes called querier routers) running IGMP version 1.

When IGMP is enabled on the switch, and on particular interfaces, it sends out IGMP queries on all IGMP interfaces. If it receives an IGMP message from a router with a lower IP address on an interface, it knows that another switch is acting as the IGMP designated router for that subnetwork. If it receives no IGMP messages with a lower IP address, it takes the role of designated switch for that subnetwork. If it is the designated switch, it continues to send out general IGMP *Host Membership Queries* regularly on this interface.

When an IP host hears a general IGMP Host Membership Query from the switch, it sends an IGMP *Host Membership Report* back to the switch. All the IGMP routers on the subnetwork put an entry into their *local group database*, so that the switches know which interfaces to send packets for this multicast group out of. These entries are updated regularly, as long as the interface has a member of the multicast group connected to it. As hosts join and leave multicast groups dynamically, the switch keeps a list of group memberships for each of its primary interfaces. In the case of multihomed interfaces, the primary interface is the first interface to be configured.

When an IP host stops belonging to a multicast group, it sends an IGMP *Leave* message to the switch. The switch then sends one or more group-specific IGMP membership queries, and any other IP hosts belonging to the same multicast group reply with a Host Membership Report. IGMP then knows whether there are still any members of this multicast group connected to the interface.

Configuring IGMP

IGMP is disabled by default on the switch, and on all interfaces. To enable or disable IGMP on the switch, use the commands:

```
enable ip igmp
disable ip igmp
```

IGMP snooping is enabled by default and is independent of IGMP.

IGMP must be enabled on an interface before it can send or receive IGMP messages on the interface. To enable or disable IGMP on an interface, use the commands:

```
enable ip igmp interface=interface
disable ip igmp interface=interface
```

IGMP keeps the local group database up to date with current multicast group members by updating it when it hears IGMP Host Membership Reports on an interface. If the switch is the IGMP designated router for the subnetwork, it sends out IGMP Host Membership Queries at a Query Interval. If it does not receive a Host Membership Report for a multicast group on an interface within the Timeout period, it deletes the multicast group from its local group database. The default of the Query Interval (125 seconds) and of the Timeout ((2*Query Interval) + 10 seconds) suit most networks. These defaults should be changed with caution, and with a sound understanding of how they affect interaction with other devices. To change the intervals, use the command:

```
set ip igmp [lmqi=1..255] [lmqc=1..5]
   [queryinterval=1..65535] [queryresponseinterval=1..255]
   [robustness=1..5] [timeout=1..65535]
```

IGMP can be configured to monitor the reception of IGMP general query messages on an interface, and generate a log message and an SNMP trap if a general query message is not received within a specified time interval. To configure monitoring on an interface, use the command:

```
set ip igmp interface=interface querytimeout={none|0|
   1..65535}
```

To display information about IGMP and multicast group membership, use the command:

```
show ip igmp [interface=interface] [destination=ipadd]
```

If IGMP snooping is enabled, this command also displays the ports listening to the multicast group for each VLAN-based IP interface.

To display IGMP counters, use the command:

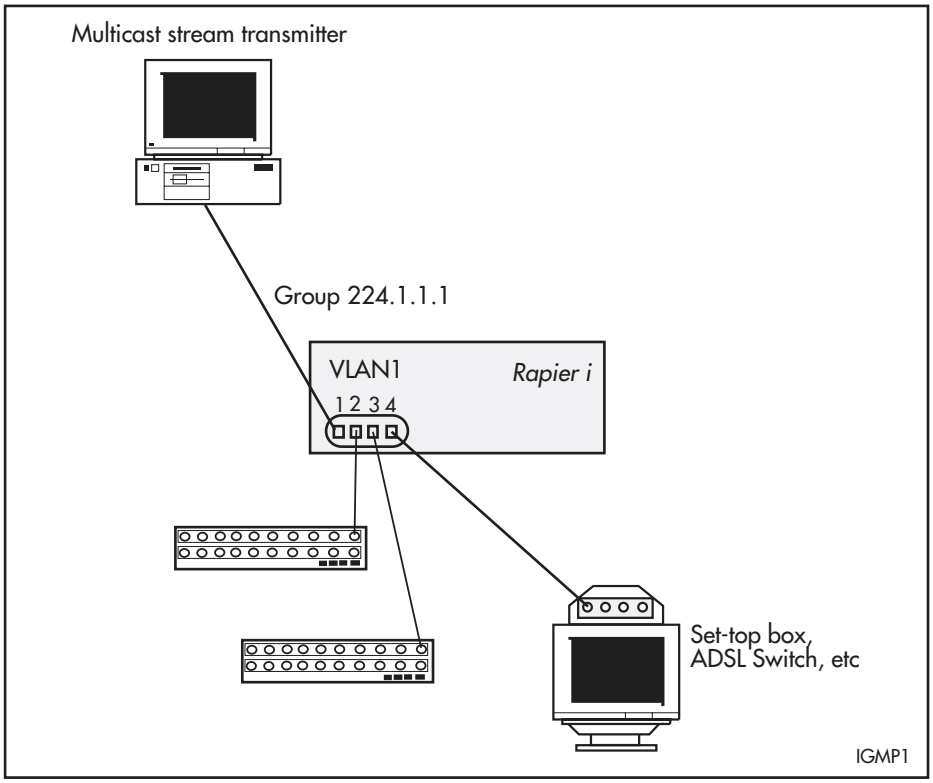
```
show ip igmp counter [interface=interface]
   [destination=ipadd]
```

Static IGMP

Static IGMP forwards multicast data over specific interfaces and ports. It is an alternative to dynamic IGMP, and is useful for network segments that have no multicast group members or have hosts that are unable to report group membership with IGMP. A dynamic IGMP configuration does not send multicast traffic to these network segments.

Figure 2 shows a switch forwarding the multicast stream to a set-top box after a user specifies that group 224.1.1.1 multicast data should be forwarded out of port 4 of VLAN1. Unlike conventional IGMP membership, this user-specified *static membership* never times out. You can also filter some IGMP debug messages by source IP address and group destination address.

Figure 2: Forwarding multicast data over a specific interface and port



To enable IGMP on the switch, use the command:

```
enable ip igmp
```

To enable IGMP on a specific interface, use the command:

```
enable ip igmp interface=interface
```

To create the static IGMP association, use the command:

```
create ip igmp destination=ipaddress interface=interface
    [port={all|port-list}]
```

The multicast data for the group specified by the **destination** parameter is forwarded over the ports specified by the **port** parameter. If the **port** parameter is not entered, the association defaults to all ports belonging to the interface.

To display information about the static IGMP association, use the command:

```
show ip igmp [interface=interface] [destination=ipaddress]
```

Any of the four octets of the IP address may be replaced by an asterisk (*) to enable wildcard matches.

To add more ports to an association, use the command:

```
add ip igmp destination=ipaddress interface=interface
   port={all|port-list}
```

Unlike dynamic IGMP group membership information, static IGMP associations never time out. If the network configuration changes, they must be manually modified. To delete ports from an association, use the command:

```
delete ip igmp destination=ipaddress interface=interface
   port={all|port-list}
```

To remove an association from a switch, use the command:

```
destroy ip igmp destination=ipaddress interface=interface
```

To enable or disable IGMP debugging of destination and source IP addresses, use the commands:

```
enable ip igmp debug [destination={all|ipaddress}]
   [sourceipaddress={all|ipaddress2}]
```

```
disable ip igmp debug
```

Debugging is disabled by default. To display which debugging options are set, use the command:

```
show ip igmp debug
```

IGMP Proxy

In a network with a simple tree topology, you can use IGMP proxy to simply the configuration of multicast routing. The switch at the root of the tree must run a multicast routing protocol, but all other switches in the network can be configured as IGMP proxy agents.

The IGMP proxy agent must be configured with a single upstream interface and one or more downstream interfaces. An upstream interface is an interface in the direction towards the root of the tree. A downstream interface is an interface in the direction away from the root of the tree.

The IGMP proxy agent periodically transmits IGMP general membership queries to the hosts attached to its downstream interfaces. The proxy agent uses IGMP report and leave messages received on downstream interfaces to build and maintain a database of multicast group memberships, and reports changes to the list of multicast groups in the database on the upstream interface. The following table summarises how the IGMP proxy agent processes each IGMP message type.

When this message...	Is received on this interface...	Then the IGMP proxy agent...
Report	downstream	• adds the membership subscription to the multicast group membership database • forwards the report message on the upstream interface, if the membership subscription is for a new multicast group
	upstream	• discards the message without processing

When this message...	Is received on this interface...	Then the IGMP proxy agent...
Leave	downstream	• removes the membership subscription from the multicast group membership database • forwards the leave message on the upstream interface, if there are no remaining membership subscriptions for the multicast group (no other hosts connected to any of the downstream interfaces have members of the multicast group)
	upstream	• discards the message without processing
Group-specific query	downstream	• discards the message without processing
	upstream	• transmits a report message on the upstream interface, if the multicast group membership database contains at least one member of the multicast group attached to a downstream interface
General query	downstream	• discards the message without processing
	upstream	• transmits a report message on the upstream interface for each multicast group in the multicast group membership database with at least one member attached to a downstream interface

The IGMP proxy agent uses the information maintained in the multicast group membership database to forward multicast data packets received on the upstream interface to all downstream interfaces that have members of the multicast group.

Multicast packet forwarding is enabled as long as:

- a multicast routing protocol is not enabled
- an interface is configured with IGMP proxy in the upstream direction
- at least one interface is configured with IGMP proxy in the downstream direction

To add an IP interface and configure IGMP proxying, use the command:

```
add ip interface=interface ipaddress={ipadd|dhcp}
   [igmpproxy={off|upstream|downstream}] [other-options...]
```

To configure IGMP proxy on an existing IP interface, use the command:

```
set ip interface=interface
   igmpproxy={off|upstream|downstream}]
```

IGMP proxy is turned off by default.

IGMP must also be enabled on the switch and on the interface for IGMP proxy to function.

To enable IGMP on the switch, use the command:

```
enable ip igmp
```

To enable IGMP on a specific interface, use the command:

```
enable ip igmp interface=interface
```

You can configure the IGMP proxy agent to monitor the reception of IGMP general query messages on an interface, and to generate a log message and an SNMP trap if an IGMP general query message is not received on the interface within a specified time interval.

To enable monitoring on an interface and set the time interval, use the command:

```
set ip igmp interface=interface querytimeout={none|0|
   1..65535}
```

To display information about IGMP and the IGMP proxy agent, use the command:

```
show ip igmp
```

IGMP Snooping

IGMP snooping lets switches intelligently forward multicast traffic instead of flooding all ports in the VLAN. Because IGMP is an IP-based protocol, multicast group membership for VLAN-aware devices is on a per-VLAN basis. If at least one port in the VLAN is a member of a multicast group and IGMP snooping is not enabled, multicast packets are flooded out all ports in the VLAN.

When IGMP snooping is enabled, the switch listens to IGMP membership reports, queries, and leave messages to identify which ports are members of multicast groups. Multicast traffic is then forwarded only to ports that are members of the multicast group.

IGMP snooping happens automatically at Layer 2 on VLAN interfaces. By default, the switch forwards traffic from ports with multicast listeners, and does not act as a simple hub and flood multicast traffic from all ports. IGMP snooping is independent of the IGMP and Layer 3 configuration, so an IP interface does not have to be attached to the VLAN, and IGMP does not have to be enabled or configured.

IGMP snooping is enabled by default. To disable it, use the command:

```
disable igmpsnooping
```

Disabling IGMP snooping may be useful when filters are used extensively because IGMP snooping uses a Layer 3 filter. When IGMP snooping is disabled, this filter becomes available. See “Hardware Packet Filters” in the *Switching* chapter of your Software Reference for information about filters. Note that multicast packets flood the VLAN when IGMP snooping is disabled.

To enable IGMP snooping, use the command:

```
enable igmpsnooping
```

IGMP snooping can be enabled only when a free filter entry is available.

To display information about IGMP snooping, use the command:

```
show igmpsnooping [vlan={vlan-name|1..4094}]
```

To display counters for IGMP snooping, use the command:

```
show igmpsnooping counter [vlan={vlan-name|1..4094}]
```

Downstream routers

IGMP snooping learns which ports have routers attached to them, so it can forward relevant IGMP messages and other IP multicast traffic out those ports. You can specify the following aspects of this:

- the kind of packets that indicate to IGMP snooping that a port has a router downstream
- which specific ports have routers downstream

Packets that indicate routers

By default, IGMP snooping identifies router ports by looking for ports that receive specific multicast packets (such as IGMP queries, PIM messages, OSPF messages, and RIP messages). You can determine what kinds of packets indicate a router is downstream, by using the command:

```
set igmpsnooping routermode={all|default|ip|multicastrouter|
   none}
```

For each option in this command, the following table lists the addresses that IGMP snooping uses to indicate that a port has a router downstream.

This option...	means that the port is treated as a multicast router port if it receives packets from...
all	any reserved multicast addresses (224.0.0.1 to 224.0.0.255)
multicastrouter	224.0.0.4 (DVMRP routers) 224.0.0.13 (all PIM routers)
default	224.0.0.1 (IGMP Queries) 224.0.0.2 (all routers on this subnet) 224.0.0.4 (DVMRP routers) 224.0.0.5 (all OSPFIGP routers) 224.0.0.6 (OSPFIGP designated routers) 224.0.0.9 (RIP2 routers) 224.0.0.13 (all PIM routers) 224.0.0.15 (all CBT routers)
ip	the current list of addresses, plus addresses specified using the command **add igmpsnooping routeraddress** and minus addresses specified using the command **delete igmpsnooping routeraddress**.

If you specify **set igmpsnooping routermode=ip**, then you can add and remove reserved IP multicast addresses to and from the list of router multicast addresses by using the commands:

```
add igmpsnooping routeraddress=ipadd-list
```

```
delete igmpsnooping routeraddress=ipadd-list
```

The IP addresses specified must be from 224.0.0.1 to 224.0.0.255.

To display the current mode and list of multicast router addresses, use the command:

```
show igmpsnooping routeraddress
```

Static multicast router ports

In some network configurations, the learning process cannot identify all router ports. For such networks, you can statically configure particular ports as multicast router ports.

To specify the static router ports, use the command:

```
add igmpsnooping vlan={vlan-name|1..4094}
   routerport=port-list
```

To stop ports from being static router ports, use the command:

```
delete igmpsnooping vlan={vlan-name|1..4094}
   routerport=port-list
```

To list the static router ports, use the command:

```
show igmpsnooping
```

Fast Leave

When an IGMP group-specific leave message is received on a port, IGMP Snooping stops the transmission of the group multicast stream after a timeout period. The **lmqi** (Last Member Query Interval) and **lmqc** (Last Member Query Count) parameters of the **set ip igmp** command set the timeout period. This timeout period allows other hosts on the port to register their membership of the multicast group and continue receiving the stream.

The Fast Leave feature allows IGMP Snooping to stop the transmission of a group multicast stream from a port as soon as it receives a leave message, without waiting for the timeout period.

Use the Fast Leave feature to improve bandwidth management on ports that are connected to a single host. Fast Leave should not be configured on a port that has multiple hosts attached because it may adversely affect multicast services to some hosts.

Fast Leave processing is disabled by default. To enable Fast Leave on a specific VLAN, or all VLANs on the switch, use the command:

```
set igmpsnooping vlan={vlan-name|1..4094} fastleave={on|yes|
   true}
```

To disable Fast Leave on a specific VLAN, or all VLANs on the switch, use the command:

```
set igmpsnooping vlan={vlan-name|1..4094} fastleave={off|no|
   false}
```

To display the current state of Fast Leave processing on a specific VLAN, or all VLANs on the switch, use the command:

```
show igmpsnooping [vlan={vlan-name|1..4094}]
```

Query Solicitation

Query solicitation minimises loss of multicast data after a topology change on networks that use spanning tree (STP, RSTP, or MSTP) for loop protection and IGMP snooping.

When IGMP snooping is enabled on a VLAN, and Spanning Tree (STP, RSTP, or MSTP) changes the underlying link layer topology of that VLAN, this can interrupt multicast data flow for a significant length of time. Query solicitation prevents this by monitoring the VLAN for any topology changes. When it

detects a change, it generates a special IGMP Leave message known as a Query Solicit, and floods the Query Solicit message to all ports. When the IGMP Querier receives the message, it responds by sending a General Query. This refreshes snooped group membership information in the network.

Query solicitation functions by default (without you enabling it) on the root bridge in an STP topology. By default, the root bridge always sends a Query Solicit message when the topology changes.

In other switches in the network, the query solicitation is disabled by default, but you can enable it by using the command:

```
set igmpsnooping vlan={vlan-name|1..4094|all}
   querysolicit={on|yes|true}
```

If you enable query solicitation on a switch other than the STP root bridge, both that switch and the root bridge send a Query Solicit message.

Once the Querier receives the Query Solicit message, it sends out a General Query and waits for responses, which update the snooping information throughout the network. If necessary, you can reduce the time this takes by tuning the IGMP timers, especially the **queryresponseinterval** parameter. For more information, see the "IGMP Timers and Counters" section of "How To Configure IGMP on Allied Telesyn Routers and Switches for Multicasting". This How To Note is available in the Resource Center of the Documentation and Tools CDROM for Software Version 2.8.1, or from www.alliedtelesis.co.uk/en-gb/solutions/techdocs.asp?area=howto

On any switch, you can disable query solicitation by using the command:

```
set igmpsnooping vlan={vlan-name|1..4094|all}
   querysolicit={off|no|false}
```

To see whether query solicitation is on or off, check the Query Solicitation field in output of the **show igmpsnooping** command on page 86.

Blocking All-Groups Entries

IGMP snooping all-groups allows you to prevent a port or ports from acting as an all-groups entry.

Sometimes the device cannot differentiate between certain multicast addresses and permanent host groups at Layer 2. For example, this happens with the addresses 239.0.0.2 and 224.0.0.2 where 224.0.0.2 is the all-routers multicast group. If the device receives an IGMP report for the 239.0.0.2 address, which has a MAC address of 01-00-5e-00-00-02, the device creates an all-groups entry in the MARL. All further multicast groups are added to this port, so multicast traffic is forwarded out the port.

By preventing a port or ports from receiving an all-groups entry, you can limit the number of router ports on the device, and therefore the volume of multicast traffic sent over the device's ports. Once disabled with the **disable ip igmp allgroup** command, the port no longer creates MARL entries when the device receives an IGMP report, query, or multicast data over any other port. For example, if port 9 has been disabled as an all-groups port, an all-groups entry will be created for port 9. This will happen when the port receives packets that will create an IGMP router port, such as reserved multicast groups and IGMP queries. However, a subsequent IGMP report received over port 7 will have an

entry made for port 7 only. The IGMP group received on port 7 will not be added to port 9.

The all-groups disabled ports can be viewed in the output of the **show ip igmp** and **show igmpsnooping** commands.

IGMP Filtering

IGMP filtering lets you manage the distribution of multicast services on each switch port by controlling which multicast groups the hosts attached to a switch port can join.

IGMP filtering is applied to multicast streams forwarded by IGMP, IGMP Snooping, or MVR.

IGMP filtering and throttling can be applied separately, or together, on the same switch port. Filtering is applied first, and any multicast group memberships passed by the filter are further subjected to the limits imposed by throttling. For more information about IGMP throttling, see "IGMP Throttling" on page 28.

Static associations of switch ports and multicast groups are not affected by IGMP filtering.

When to use IGMP filters

Use an IGMP filter to:

- limit the multicast groups a downstream port can be a member of, by applying a filter that matches IGMP report messages to the port
- limit the impact of misbehaving devices by applying a filter that matches inappropriate IGMP messages, for example, query messages on a downstream port or leave messages on an upstream port

Filter format

An IGMP filter consists of zero or more entries. An entry consists of:

- A multicast address range to match against. Address ranges in multiple entries can overlap.
- An IGMP message type to match—query, report, or leave.
- An action to take (include or exclude) when an IGMP message is received that matches the multicast address range and message type.

Matching against a filter

When an IGMP filter is applied to a switch port the following happens:

1. IGMP matches incoming IGMP messages from the switch port against each entry in the filter applied to the port.
2. If the message type and group address in the IGMP message matches a filter entry, IGMP takes the action specified by the filter entry:
   - If the action is **include**, IGMP processes the IGMP message as normal.
   - If the action is **exclude**, IGMP excludes the IGMP message from normal IGMP processing and discards the packet.

   Filter processing stops when a match is found.
3. If the IGMP message does not match any entry in the filter, but the filter contains at least one entry that matches the message type, then IGMP excludes the IGMP message from normal IGMP processing and discards the packet.

Applying an empty IGMP filter (a filter with no entries) to a switch port allows all incoming IGMP messages to be processed as normal.

Order of entries

The order of entries in a filter is important. When IGMP tries to match an IGMP message to a filter, it performs a linear search of the filter to find a matching entry. Each entry is tried in turn, and processing stops at the first match found.

Address ranges can overlap. If the address range of an entry falls entirely within the address range of another entry, the entry with the smaller address range should appear first in the filter. Otherwise it will never be matched against an IGMP message.

Performance can be improved by arranging the entries in a filter to achieve the earliest possible match.

Configuring IGMP filters

To configure an IGMP filter, you must create the filter and then apply it to one or more switch ports.

To do this, first create the filter by using the command:

```
create igmp filter=filter-id
```

Then add one or more entries to the filter with the command:

```
add igmp filter=filter-id groupaddress={ipadd|ipadd-ipadd}
    [msgtype={query|report|leave}] [action={include|exclude}]
    [entry=1..65535]
```

Finally, apply the filter to a switch port with the command:

```
set switch port={port-list|all} igmpfilter=filter-id
    [other-options...]
```

You can apply an IGMP filter to more than one switch port, but a single switch port can have only one IGMP filter assigned to it.

To delete or modify an entry in a filter, use the commands:

```
delete igmp filter=filter-id entry=1..65535
```

```
set igmp filter=filter-id entry=1..65535
    [groupaddress={ipadd|ipadd-ipadd}] [msgtype={query|
    report|leave}] [action={include|exclude}]
```

To remove a filter from a switch port, use the command:

```
set switch port={port-list|all} igmpfilter=none
    [other-options...]
```

To destroy a filter, first remove the filter from all ports that it is applied to, then use the command:

```
destroy igmp filter=filter-id
```

To display information about IGMP filters, use the command:

```
show igmp filter=filter-id
```

To display the IGMP filter assigned to a switch port, use the command:

```
show switch port[={port-list|all}]
```

IGMP Throttling

IGMP throttling lets you manage the distribution of multicast services on each switch port by limiting the number of multicast groups that a host on a switch port can join.

IGMP throttling is applied to multicast streams forwarded by IGMP, IGMP Snooping, or MVR.

IGMP filtering and throttling can be applied separately, or together, on the same switch port. Filtering is applied first, and any multicast group memberships passed by the filter are further subjected to the limits imposed by throttling. For more information about IGMP filtering, see "IGMP Filtering" on page 26.

IGMP throttling controls the maximum number of multicast groups that a port can join. When the number of multicast group memberships associated with a switch port reaches the limit set, further Membership Reports are subject to a throttling action—deny or replace.

If you configure a throttling action of **deny**, when the multicast group membership associated with the port reaches the set limit, additional Membership Reports from that switch port are denied until old membership entries are aged out.

If you configure a throttling action of **replace**, when the multicast group membership associated with the port reaches the set limit, additional Membership Reports from that switch port replace existing membership entries.

Static associations of switch ports and multicast groups are counted in the number of multicast group memberships, but they are not affected by the throttling action.

Configuring IGMP throttling

To enable IGMP throttling on a switch port, set the maximum number of group memberships and the throttling action to take, by using the command:

```
set switch port={port-list|all} igmpmaxgroup=1..65535
   igmpaction={deny|replace} [other-options...]
```

To disable IGMP throttling on a switch port, set the maximum number of group memberships to **none** by using the command:

```
set switch port={port-list|all} igmpmaxgroup=none
   [other-options...]
```

To display the IGMP throttling settings for a switch port, use the command:

```
show switch port[={port-list|all}]
```

Multicast Switching

IP multicast switching (in hardware) between VLANs is automatically enabled when **both** of the following are true:

- a multicast routing protocol (PIM-SM or PIM-DM) is enabled
- an interface is configured for that multicast routing protocol.

VLAN tagging is fully supported, and the Time To Live (TTL) value in the IP header is decremented. Multicast switching cannot be disabled.

Multicast VLAN Registration (MVR)

Multicast VLAN Registration (MVR) is used by applications receiving multicast traffic across an Ethernet ring-based service provider network (for example, broadcasting several television channels).

MVR operates on the underlying mechanism of the Internet Group Management Protocol (IGMP) function (see "Internet Group Management Protocol (IGMP)" on page 17), and requires that IGMP be enabled. Receiver ports join and leave multicast streams by sending IGMP messages. With IGMP and MVR both enabled, MVR reacts to join and leave messages from the multicast group configured under MVR. IGMP reacts to all messages.

Once MVR is configured, the CPU sets up a forwarding table in which each entry matches the multicast stream to an associated MAC address. The CPU then intercepts the IGMP messages and modifies the forwarding table to include or remove the receiver port as a receiver of the multicast stream. This selectively allows traffic to cross between different VLANs.

Up to five multicast VLANs can be set up on a switch, and a total of 256 group IP addresses can be added to the switch, divided up to belong to different multicast VLANs.

Whenever MVR is enabled on the switch, multicast routing must be disabled.

Dynamic MVR

In *dynamic mode,* after the switch receives IGMP information packets, it processes the data message, and resends those messages to a multicast router through its source ports. The switch knows which multicast groups exist on which interface when it receives a join message from the interface for the group. It forwards the multicast stream to that interface.

Compatible MVR

In *compatible mode*, IGMP report messages are not sent through source ports. The multicast router must be statically configured so it can forward multicast streams to particular interfaces.

Immediate Leave

The *immediate leave* parameter (**imtleave**) allows a receiver port to leave the multicast group as soon an IGMP Leave message is received by the switch on that port. Immediate leave can be specified in the following commands:

```
create ip mvr vlan=vlan-id sourceport=port-list
   receiverport=port-list [imtleave=port-list]
   [mode={dynamic|compatible}]

set ip mvr vlan=vlan-id [imtleave=port-list] [mode={dynamic|
   compatible}] [receiverport=port-list] [sourceport=port-
   list]
```

If immediate leave is not specified, the switch sends an IGMP query on that port and waits for the IGMP group membership reports when it receives an IGMP Leave message. If it receives no reports within the configured IGMP time period (see the **set ip igmp** command on page 75), the receiver port leaves the multicast group. The port numbers specified must be members of the receiver port list. If the immediate leave parameter is not specified, the function is disabled on all receiver ports.

Configuring MVR

MVR is disabled by default, and must be enabled on the switch to start multicast VLAN registration. To enable or disable MVR, use the commands:

```
enable ip mvr

disable ip mvr
```

To create MVR on, or remove MVR from the switch, use the commands:

```
create ip mvr vlan=vlan-id sourceport=port-list
   receiverport=port-list [other parameters]

destroy ip mvr vlan=vlan-id
```

To add or delete an MVR IP multicast group address or range of addresses, use the command:

```
add ip mvr vlan=vlan-id groupaddress=ipadd[-ipadd]

delete ip mvr vlan=vlan-id groupaddress=ipadd[-ipadd]
```

To set parameters for the MVR mode, receiver ports, source ports, and ports with the immediate leave function, use the command:

```
set ip mvr vlan=vlan-id [imtleave=port-list] [mode={dynamic|
   compatible}] [receiverport=port-list] [sourceport=port-
   list]
```

To display all information about the MVR configuration, use the command:

```
show ip mvr [vlan=vlan-id]
```

Configuration Examples

This section contains the following multicasting configurations that use IGMP:

- Static IGMP
- Protocol Independent Multicast (PIM)

Static IGMP

The following example shows how to create a static IGMP association. It assumes that *vlan1* has already been configured as an IP interface on the switch.

1. **Enable IGMP on the switch.**

   ```
   enable ip igmp
   ```

2. **Enable IGMP on vlan1.**

   This must be done before the static IGMP association is created.

   ```
   enable ip igmp interface=vlan1
   ```

3. **Create the static IGMP association.**

   The multicast data for the group specified by the **destination** parameter is forwarded over ports specified by the **port** parameter. If the **port** parameter is not entered, the association defaults to all ports belonging to the interface.

   ```
   create ip igmp destination=224.1.2.3 interface=vlan1
      port=1-4
   ```

4. **Check the configuration.**

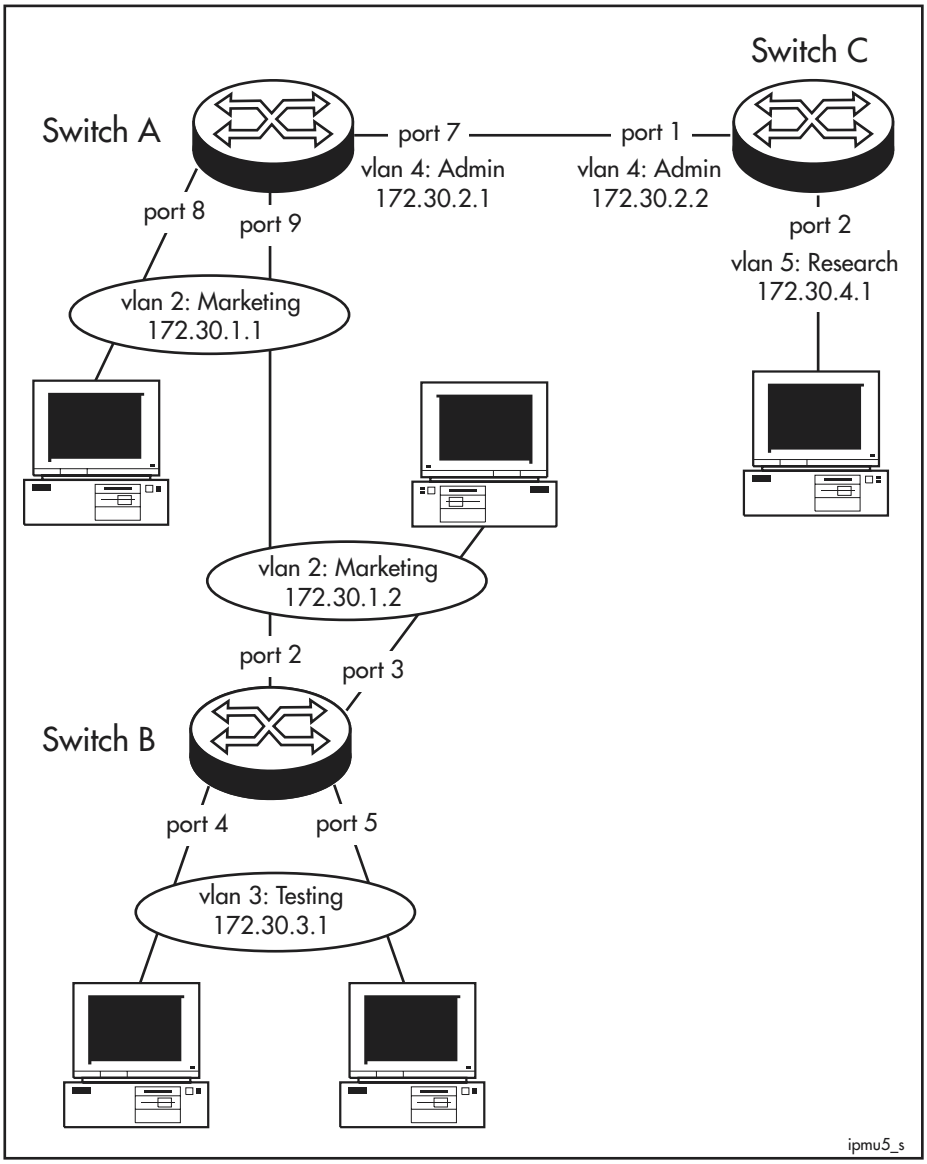
   Check that the static IGMP association has been created and IGMP is enabled.

   ```
   show ip igmp destination=224.1.2.3 interface=vlan1
   ```

Protocol Independent Multicast (PIM)

These examples use PIM-SM or PIM-DM for multicast routing between three switches. The network topology is the same for each example (Figure 3). Multicast group management uses IGMP. The examples assume that each switch starts from the default configuration.

Figure 3: Multicast configuration using PIM sparse or dense mode.



PIM-SM This example uses PIM Sparse Mode and allows IP hosts to send data to and receive data from the multicast groups 225.1.0.0 to 225.1.0.255. The configuration of Switches A, B, and C are very similar, but Switch A is the only switch configured as a PIM Bootstrap Router Candidate and a PIM rendezvous point candidate.

To configure Switch A

1. **Set the system name for the switch.**

```
set sys name=A-pim-rp
```

2. Configure the VLANs.

Configure the *marketing* VLAN, including ports 8 and 9.

```
create vlan=marketing vid=2
add vlan=2 port=8,9
```

Configure the *admin* VLAN, including port 7.

```
create vlan=admin vid=4
add vlan=4 port=7
```

3. Configure IP.

Enable IP and assign IP addresses for the VLAN interfaces.

```
enable ip
add ip interface=vlan2 ipaddress=172.30.1.1
   mask=255.255.255.0
add ip interface=vlan4 ipaddress=172.30.2.1
   mask=255.255.255.0
```

4. Configure a unicast routing protocol.

Enable RIP over all interfaces.

```
add ip rip int=vlan2
add ip rip int=vlan4
```

5. Configure IGMP.

Enable IGMP on the switch for group management.

```
enable ip igmp
```

Enable IGMP on each interface, so that IGMP can find which multicast groups have hosts connected to the interfaces.

```
enable ip igmp interface=vlan2
enable ip igmp interface=vlan4
```

IGMP snooping is enabled by default, so does not need to be configured.

6. Configure PIM.

Define PIM interfaces for the VLAN interfaces.

```
add pim interface=vlan2
add pim interface=vlan4
```

The network must have a PIM bootstrap router, so at least one switch in the network must be configured as a Bootstrap Router Candidate. Set this switch to be the Bootstrap Router Candidate.

```
add pim bsrcandidate
```

At least one switch in each multicast group must be a PIM rendezvous point (RP) for the multicast group, so at least one switch in each group must be configured as a rendezvous point candidate. Set this switch to be an RP candidate.

```
add pim rpcandidate group=225.1.0.0 mask=255.255.255.0
```

Enable PIM multicast routing.

```
enable pim
```

To configure Switch B

1. Set the system name.

Set a unique system name on the switch.

```
set sys name=B-pim
```

2. Configure the VLANs.

Configure the *marketing* VLAN, including ports2 and 3.

```
create vlan=marketing vid=2
add vlan=2 port=2,3
```

Configure the *testing* VLAN, including ports 4 and 5.

```
create vlan=testing vid=3
add vlan=3 port=4,5
```

3. Configure IP.

Enable IP, and assign IP addresses to the VLAN interfaces.

```
enable ip
add ip interface=vlan2 ipaddress=172.30.1.2 mask=
   255.255.255.0
```

4. Configure a unicast routing protocol.

Enable RIP over all interfaces.

```
add ip rip int=vlan2add ip rip int=vlan3
```

5. Configure IGMP.

Enable IGMP on the switch for group management.

```
enable ip igmp
```

Enable IGMP on each interface, so that IGMP can find which multicast groups have hosts connected to the interfaces.

```
enable ip igmp interface=vlan2
enable ip igmp interface=vlan3
```

IGMP snooping is enabled by default, so does not need to be configured.

6. Configure PIM.

Define PIM interfaces for the VLAN interfaces.

```
add pim interface=vlan2
add pim interface=vlan3
```

Enable PIM multicast routing.

```
enable pim
```

To configure Switch C

1. Set the system name.

Set a unique system name on the switch.

```
set sys name=C-pim
```

2. **Configure the VLANs.**

   Configure the *admin* VLAN, including port 1.

   ```
   create vlan=admin vid=4
   add vlan=4 port=1
   ```

   Configure the *research* VLAN, including port2.

   ```
   create vlan=research vid=5
   add vlan=5 port=2
   ```

3. **Configure IP.**

   Enable IP on the switch.

   ```
   enable ip
   ```

   Assign IP addresses to the VLAN interfaces.

   ```
   add ip interface=vlan4 ipaddress=172.30.2.2 mask=
      255.255.255.0
   add ip interface=vlan5 ipaddress=172.30.4.1
      mask= 255.255.255.0
   ```

4. **Configure a unicast routing protocol.**

   Enable RIP over all interfaces.

5. `add ip rip int=vlan4add ip rip int=vlan5`**Configure IGMP.**

   Enable IGMP on the switch for group management.

   ```
   enable ip igmp
   ```

   Enable IGMP on each interface, so that IGMP can find which multicast groups have hosts connected to the interfaces.

   ```
   enable ip igmp interface=vlan4
   enable ip igmp interface=vlan5
   ```

   IGMP snooping is enabled by default, so does not need to be configured.

6. **Configure PIM.**

   Define PIM interfaces for the VLANinterfaces.

   ```
   add pim interface=vlan5
   add pim interface=vlan4
   ```

   Enable PIM multicast routing.

   ```
   enable pim
   ```

Confirm multicasting

When the three switches have been configured, RIP takes a few seconds to distribute the unicast routing information to all routers. The IP hosts connected to these interfaces can then send and receive multicasts.

1. **Test multicasting.**

   Test whether IP multicasting is successful by sending IP multicast data between hosts connected to each of the switches. Check that IGMP report and leave messages are correctly processed by having hosts leave and join groups.

2. **Check the multicast state.**

   To check each switch, use the commands:

   ```
   show pim

   show ip igmp

   show ip route multicast
   ```

PIM-DM

This example uses PIM Dense Mode for multicast routing between switches in the same topology as the PIM Sparse Mode example (Figure 3 on page 32). Multicast group management uses IGMP. The example assumes that each switch starts from the default configuration.

The configurations of Switch A, B, and C are identical except for names and interfaces.

To configure Switch A

1. **Set the system name for the switch.**

   ```
   set sys name=A-pim-dm
   ```

2. **Configure the VLANs.**

   Configure the *marketing* VLAN, including ports 8 and 9.

   ```
   create vlan=marketing vid=2

   add vlan=2 port=8,9
   ```

   Configure the *admin* VLAN, including port 7.

   ```
   create vlan=admin vid=4

   add vlan=4 port=7
   ```

3. **Configure IP.**

   Enable IP and assign IP addresses for the VLAN interfaces on the switch.

   ```
   enable ip

   add ip interface=vlan2 ipaddress=172.30.1.1
      mask=255.255.255.0

   add ip interface=vlan4 ipaddress=172.30.2.1
      mask=255.255.255.0
   ```

4. **Configure a unicast routing protocol.**

   Enable RIP over all interfaces.

   ```
   dd ip rip int=vlan2

   add ip rip int=vlan4
   ```

5. **Configure IGMP.**

   Enable IGMP on the switch for group management.

   ```
   enable ip igmp
   ```

   Enable IGMP on each interface, so that IGMP can find which multicast groups have hosts connected to the interfaces.

   ```
   enable ip igmp interface=vlan2

   enable ip igmp interface=vlan4
   ```

   IGMP snooping is enabled by default, so does not need to be configured.

6. Configure PIM.

Define PIM interfaces for the VLAN interfaces.

```
add pim interface=vlan2 mode=dense
add pim interface=vlan4 mode=dense
```

Enable PIM multicast routing.

```
enable pim
```

To configure Switch B

1. Set the system name.

Set a unique system name on the switch.

```
set sys name=B-pim
```

2. Configure the VLANs.

Configure the *marketing* VLAN, including ports 2 and 3.

```
create vlan=marketing vid=2
add vlan=2 port=2,3
```

Configure the *testing* VLAN, including ports 4 and 5.

```
create vlan=testing vid=3
add vlan=3 port=4,5
```

3. Configure IP.

Enable IP, and assign IP addresses to the VLAN interfaces.

```
enable ip
add ip interface=vlan2 ipaddress=172.30.1.2
   mask=255.255.255.0
add ip interface=vlan3 ipaddress=172.30.3.1
   mask=255.255.255.0
```

4. Configure a unicast routing protocol.

Enable RIP over all interfaces.

```
add ip rip int=vlan2
add ip rip int=vlan3
```

5. Configure IGMP.

Enable IGMP on the switch for group management.

```
enable ip igmp
```

Enable IGMP on each interface, so that IGMP can find which multicast groups have hosts connected to the interfaces.`enable ip igmp interface=vlan2`

```
enable ip igmp interface=vlan3
```

IGMP snooping is enabled by default, so does not need to be configured.

6. Configure PIM.

Define PIM interfaces for the VLAN interfaces.

```
add pim interfacevlan2 mode=dense
add pim interface=vlan3 mode=dense
```

Enable PIM multicast routing.

```
enable pim
```

To configure Switch C

1. Set the system name.

Set a unique system name on the switch.

```
set sys name=C-pim
```

2. Configure the VLANs.

Configure the *admin* VLAN, including port 1.

```
create vlan=admin vid=4
add vlan=4 port=1
```

Configure the *research* VLAN, including port 2.

```
create vlan=research vid=5
add vlan=5 port=2
```

3. Configure IP.

Enable IP on the switch.

```
enable ip
```

Assign IP addresses to the VLAN interfaces.

```
add ip interfacevlan4ipaddress=172.30.2.2
   mask= 255.255.255.0
add ip interface=vlan5 ipaddress=172.30.4.1
   mask= 255.255.255.0
```

4. Configure a unicast routing protocol.

Enable RIP over all interfaces.

```
add ip rip intvlan4
add ip rip int=vlan5
```

5. Configure IGMP.

Enable IGMP on the switch for group management.

```
enable ip igmp
```

Enable IGMP on each interface, so that IGMP can find which multicast groups have hosts connected to the interfaces.

```
enable ip igmp interfacevlan4
enable ip igmp interface=vlan5
```

6. **Configure PIM.**

   Define PIM interfaces for the VLAN interfaces.

   ```
   add pim interfacevlan5 mode=dense
   add pim interfacevlan4 mode=dense
   ```

   Enable PIM multicast routing.

   ```
   enable pim
   ```

Confirm multicasting

When the three switches have been configured, RIP takes a few seconds to distribute the unicast routing information to all routers. Then the IP hosts connected to these interfaces can send and receive multicasts.

1. **Test multicasting.**

   Test whether IP multicasting is successful by sending IP multicast data between hosts connected to each of the switches. Check that IGMP report and leave messages are correctly processed by having hosts leave and join groups.

2. **Check the multicast state.**

   To check each switch, use the commands:

   ```
   show pim
   show ip igmp
   show ip route multicast
   ```

Command Reference

This section describes the commands available on the switch to configure IGMP for multicast group management, and the multicast routing protocols PIM-SM (Protocol Independent Multicast - Sparse Mode) and PIM-DM (Protocol Independent Multicast - Dense Mode).

add igmp filter

Syntax

```
ADD IGMP FILter=filter-id GROupaddress={ipadd|ipadd-ipadd}
   [MSGType={QUEry|REPort|LEAVe}] [ACtion={INCLude|
   EXCLude}] [ENTry=1..65535]
```

where:

- *filter-id* is a decimal number from 1 to 99.
- *ipadd* is an IP address in dotted decimal notation.

Description

This command adds an entry to an IGMP filter. IGMP filters control a port's membership of multicast groups by filtering incoming IGMP messages from hosts attached to the port.

To take effect, the filter must be applied to a switch port by using the **set switch port** command.

The **filter** parameter specifies the number of the filter to add the entry to. The specified filter must have been created previously by using the **create igmp filter** command.

The **groupaddress** parameter specifies an IP multicast group address or a range of IP multicast group addresses to match. Set **groupaddress** to:

- 0.0.0.0 to filter IGMP general query messages
- a multicast address or a range of multicast addresses to filter IGMP group-specific query messages, report messages, and leave messages.

The **msgtype** parameter specifies the type of incoming IGMP message to match. If you specify **query**, the filter will match IGMP general and group-specific query messages. If you specify **report**, the filter will match IGMP report messages. If you specify **leave**, the filter will match IGMP leave messages. The default is **report**.

The **action** parameter specifies the action to take when an IGMP message with a message type matching **msgtype** and a group address matching **groupaddress** is received. If you specify **include**, the message is processed as normal by IGMP. If you specify **exclude**, the message is excluded from processing by IGMP, and the packet is discarded. The default is **include**.

If an IGMP filter contains at least one entry for a particular IGMP message type, then messages of the same type for group addresses that do not match any entries in the filter are implicitly excluded and the packets are discarded.

The **entry** parameter specifies the position of the entry in the filter, and identifies the entry in the filter. The specified entry number must not already be

used by another entry. If you do not specify an entry number, the entry is added after the last entry in the filter if there is a free position, or in the last unused position if the last position is already in use.

Examples To add an entry to filter 6 to accept Membership Reports for multicast group addresses in the range 229.1.1.2 to 230.1.2.3, use the command:

```
add igmp fil=6 msgt=rep gro=229.1.1.2-230.1.2.3
```

To add an entry at position 16 in filter 3 to deny Membership Reports for multicast group addresses in the range 231.1.1.20 to 231.1.5.3, use the command:

```
add igmp fil=3 ent=16 msgt=rep gro=231.1.1.20-231.1.5.3
   ac=excl
```

To add an entry to filter 1 to exclude all general queries, use the command:

```
add igmp fil=1 msgt=que gro=0.0.0.0 ac=excl
```

Related Commands
create igmp filter
delete igmp filter
destroy igmp filter
set igmp filter
show igmp filter

add igmpsnooping routeraddress

Syntax `ADD IGMPSNooping ROUTERAddress=`*`ipaddr-list`*

where *ipaddr-list* is a reserved IP multicast address in dotted decimal notation, or a comma-separated list of reserved IP multicast addresses

Description This command adds reserved IP multicast addresses to the list of router multicast addresses. The IP address specified must be from 224.0.0.1 to 224.0.0.255. This command is valid when IGMP snooping router mode is set to IP with the **set igmpsnooping routermode** command.

Examples To add addresses 224.0.0.25 and 224.0.0.86 to the router multicast address list, use the command:

```
add igmpsn routera=224.0.0.25,224.0.0.86
```

Related Commands
delete igmpsnooping routeraddress
set igmpsnooping routermode
show igmpsnooping routeraddress

add igmpsnooping vlan

Syntax

```
ADD IGMPSNooping VLAN={vlan-name|1..4094}
   ROUTERPort=port-list
```

where

- *vlan-name is* a unique name from 1 to 32 characters. Valid characters are uppercase and lowercase letters, digits, the underscore, and hyphen. The *vlan-name* cannot be **all**.
- *port-list* is a port number, range (specified as *n-m*), or comma-separated list of numbers and/or ranges. Port numbers start at 1 and end at *m*, where *m* is the highest numbered Ethernet switch port.

Description

This command configures ports as multicast router ports. The switch forwards relevant IGMP messages and other IP multicast traffic out these ports. This is useful for network configurations in which the switch's learning process cannot identify all multicast router ports.

The **vlan** parameter specifies a VLAN. The ports are only treated as multicast router ports for that VLAN, not for other VLANs they belong to. There is no default.

The **routerport** parameter specifies the ports in the VLAN that have multicast routers attached to them. There is no default.

Examples

To specify that port 3 in vlan2 is a multicast router port, use the command:

```
add igmpsn vlan=2 routerp=3
```

Related Commands

delete igmpsnooping routeraddress
delete igmpsnooping vlan
set igmpsnooping routermode
show igmpsnooping
show igmpsnooping routeraddress

add ip igmp destination

Syntax

```
ADD IP IGMP DEStination=ipaddress INTerface=interface
   POrt={ALL|port-list}
```

where:

- *ipaddress* is an existing IGMP group destination address.
- *interface* is the name of the interface over which multicast data is forwarded. This must be a VLAN interface.
- *port-list* is a port number, a range of port numbers (specified as a-b), or a comma-separated list of port numbers and/or ranges. Port numbers start at 1 and end at m, where *m* is the highest numbered Ethernet port, including uplink ports.

Description

This command adds additional ports through which multicast data is forwarded.

The **destination** parameter specifies the IP address to which multicast group address data is forwarded.

The **interface** parameter specifies the interface over which multicast data is forwarded. This must be a VLAN interface, for example VLAN1.

The static IGMP association identified by the **destination** and **interface** parameters must already exist.

The **port** parameter specifies the ports through which multicast data is forwarded. If any of the ports specified in the port list are already part of the association or are not valid for the specified interface, an error message is displayed.

A port may belong to several associations if it belongs to several interfaces (i.e. if there are overlapping VLANs). If one of the ports in the list already has a dynamic IGMP host, it is replaced by the new static entry.

If **all** is specified, all ports belonging to that interface forward multicast data.

Examples

To add port 5 to the list of ports through which multicast data for 224.1.2.3 is forwarded over *vlan1*, use the command:

```
add ip igmp des=224.1.2.3 int=vlan1 po=5
```

Related Commands

create ip igmp destination
delete ip igmp destination
destroy ip igmp destination
show ip igmp

add ip mvr

Syntax `ADD IP MVR VLAN=1..4094 GROupaddress=`*`ipadd`*`[-`*`ipadd`*`]`

where *ipadd* is an IP address in dotted decimal notation

Description This command adds an MVR IP multicast group address or range of addresses on a switch. All source ports and receiver ports belonging to this multicast group receive multicast data sent to this group address.

The **vlan** parameter specifies the VLAN identifier with which the multicast VLAN is associated.

The **groupaddress** parameter specifies the multicast group IP address or range of IP addresses that belong to the multicast VLAN.

Examples To add a multicast IP group address on a multicast VLAN, use the command:

```
add ip mvr vlan=22 gro=230.1.1.1
```

Related Commands **delete ip mvr**
show ip mvr

add pim bsrcandidate

Syntax

```
ADD PIM BSRCandidate [PREFerence=0..255]
   [HAShmasklength=0..32] [BSMinterval={10..15000|
   DEFault}] [INTerface=interface]
```

where *interface* is the name of the interface over which multicast data is forwarded. The interface can be either a VLAN (e.g. vlan1) or a local interface (e.g. local1).

Description

This command configures the switch to be a Bootstrap Router candidate.

The **preference** parameter specifies the preference for the switch to become the bootstrap router. A higher number means a higher priority. The default is 1.

The **hashmasklength** parameter specifies the number of bits of the group number to use when selecting a rendezvous point (RP) candidate if this switch becomes the BSR. A higher number increases the spread of groups across RPs. The default is 30.

Note that software releases prior to 2.7.3 did not correctly support the PIM hash mask length option. As a result, the RP selection calculation differs between this release and release versions prior to 2.7.3. If a network contains switches running a mixture of versions, this leads to incorrect forwarding behaviour. To avoid this issue, either ensure that all devices on the network correctly support the hash mask length option (recommended), or ensure that the following **both** hold:

- The hash mask length option on all BSR candidates is configured to 4 bits. This implies that all BSR candidates must be running 2.7.3 or later.
- All RP candidates use a common prefix of 224.0.0.0/240.0.0.0. This has the side effect of collapsing all groups to use a single PIM RP.

The **bsminterval** parameter can be used to specify the time period in seconds at which the switch sends bootstrap messages when it is elected as the bootstrap router. The default is 60 seconds. This timer is now set with the **set pim** command by preference because it applies globally to the PIM-SM domain, but this parameter has been maintained to ensure backwards compatibility.

The **interface** parameter specifies an interface for the switch to use when advertising itself as a candidate bootstrap router. The IP address of this interface is advertised by the router. The interface supplied can be either a configured local interface or a configured VLAN interface. If the parameter is not specified, the switch instead advertises its first active IP interface.

Examples

To add the switch as a Bootstrap Router Candidate to a PIM domain, with a preference of 10 to become the bootstrap router in the domain and a hash mask length of 0, use the command:

```
add pim bsrcandidate preference=10 hasmasklength=0
```

Related Commands

delete pim bsrcandidate
enable pim
set pim bsrcandidate
show pim
show pim bsrcandidate

add pim interface

Syntax

```
ADD PIM INTerface=interface [DRPriority=0..4294967295]
   [ELectby={DRPriority|IPaddress}]
   [HEllointerval={10..15000|DEFault|65535}] [MODe={Dense|
   Sparse}] [SRCapable={Yes|No}]
```

where *interface* is an interface name formed by concatenating a Layer 2 interface type, an interface instance, and optionally a hyphen followed by a logical interface number from 0 to 15. If a logical interface is not specified, 0 is assumed.

Description

This command adds the specified IP interface to the PIM interface list so that PIM multicast routing can operate on this interface. Valid interfaces are:

To see a list of current interfaces, use the **show interface** command. Note that multihomed interfaces must specify the logical interface number (e.g. ppp1-1).

The **drpriority** parameter specifies the preference for the switch to become the designated router (DR) on this interface when **electby**=**drpriority**. A higher value indicates a greater preference. The default is 1.

Note that for compatibility with previous versions, a DR priority of 65535 is treated as **electby**=**ipaddress** if **electby** has not been specified. If **electby**=**drpriority** is specified and **drpriority**=65535, then the DR priority is set to 65535.

The **electby** parameter determines how the switch elects the designated router for this interface. If **drpriority** is specified, the interface transmits its DR priority in its hello messages, which allows DR election by priority. If **ipaddress** is specified, the switch does not transmit its DR priority, which causes election by IP address. The default is **drpriority**. Note that a switch with **electby**=**drpriority** may still elect by IP address when it does not receive DR priority in any one of its neighbours' Hello messages. Election by DR priority is possible only when all routers on the interface supply their DR priority.

The **hellointerval** parameter specifies the interval at which the switch sends Hello messages from this interface. Setting the **hellointerval** parameter to 65535 results in a Hello message being sent with a hold time of 65535, which means "infinity". A router receiving this switch's Hello never expires this switch as a PIM neighbour. This can be useful on point-to-point links. The default is 30 seconds.

The **mode** parameter specifies the PIM operating mode for the interface. The default is **sparse**. All interfaces should have the same mode setting unless the switch is a Multicast Border Router.

The **srcapable** parameter indicates whether this interface originates or processes State Refresh messages. The default is **no**. This parameter applies to dense mode interfaces.

Examples

To add interface vlan2 to the PIM-SM interface list, with a priority of 3 to become the designated router for the subnetwork, use the command:

```
add pim int=vlan2 drp=3
```

Related Commands

delete pim interface
enable pim

reset pim interface
set pim interface
show pim
show pim interface

add pim rpcandidate

Syntax

```
ADD PIM RPCandidate[=rp-address] GROup=group-address
   [ADVinterval={10..15000|DEFault}] [INTerface=interface]
   [MASK=ipaddress] [PRIOrity=0..255]
```

where:

- *group-address* is the IP address of the multicast group in dotted decimal notation.
- *ipaddress* is an IP address in dotted decimal notation.
- *rp-address* is an IP address in dotted decimal notation.
- *interface* is the name of a VLAN (e.g. vlan1) or a local interface (e.g. local1).

Description

This command configures the switch to be a rendezvous point candidate for specific multicast groups. There is no limitation on the number of groups or range of groups.

The **rpcandidate** parameter, if specified with a value, is the IP address of the rendezvous point for the multicast group(s). This option can be used to create static RP mappings for networks in which the bootstrap mechanism cannot be used. If the bootstrap mechanism is also running, a static RP mapping takes precedence.

The **group** parameter specifies the multicast group(s) to which the switch is a rendezvous point candidate.

The **advinterval** parameter can be used to specify the time period in seconds at which the switch sends C-RP-Advertisements. The default is 60 seconds. This timer is now set with the **set pim** command by preference because the switch sends C-RP-Advertisements at the same rate for all groups for which it is an RP candidate, but this parameter has been maintained to ensure backwards compatibility. This parameter does not apply to static RP mappings.

The **interface** parameter specifies an interface for the switch to use when advertising itself as the candidate rendezvous point for a multicast group. The IP address of the of this interface is advertised by the switch. The **interface** supplied can be either a configured local interface or a configured VLAN interface. If the parameter is not specified, the switch advertises its first active IP interface instead.

The **mask** parameter specifies the mask for the multicast group address specified in the **group** parameter. This is useful when configuring multiple multicast groups with a common rendezvous point (RP). The default mask is 255.255.255.255.

The **priority** parameter specifies the preference for the switch to become the rendezvous point for the multicast group. A lower value indicates a higher priority. The default is 192. This parameter does not apply to static RP mappings.

Note that the switch has the same values for **priority** for all multicast groups for which it is a rendezvous point candidate, so changing this switch's priority to be the RP for one group changes it for all groups.

Examples To configure the switch to advertise that it is an RP candidate with a priority of 10 to become the RP for the multicast group with address 224.1.1.98, use the command:

```
add pim rpc gro=224.1.1.98 prio=10
```

Related Commands

delete pim rpcandidate
enable pim
set pim rpcandidate
show pim
show pim rpcandidate

create igmp filter

Syntax `CREate IGMP FILter=`*`filter-id`*

where *filter-id* is a decimal number from 1 to 99

Description This command creates an IGMP filter. IGMP filters control a port's membership of multicast groups by filtering incoming IGMP messages from hosts attached to the port.

The **filter** parameter specifies the number of the filter to create, and is used to identify the filter. A filter with the specified number must not already exist.

You can add entries to the filter to match specific multicast groups by using the **add igmp filter** command.

For the filter to take effect, you must apply the filter to a switch port using the **set switch port** command.

Applying an empty IGMP filter (a filter with no entries) to a switch port allows all incoming IGMP messages to be processed as normal.

Examples To create a filter with a filter ID of 6, use the command:

```
cre igmp fil=6
```

Related Commands
add igmp filter
delete igmp filter
destroy igmp filter
set igmp filter
show igmp filter

create ip igmp destination

Syntax

```
CREate IP IGMP DEStination=ipaddress INTerface=interface
   [POrt={ALL|port-list}]
```

where:

- *ipaddress* is an existing IGMP group destination address.
- *interface* is the name of the interface over which multicast data is forwarded.
- *port-list* is a port number, a range of port numbers (specified as *n-m*), or a comma-separated list of port numbers and/or ranges. Port numbers start at 1 and end at m, where m is the highest numbered Ethernet port, including uplink ports.

Description

This command creates a static multicast association to forward multicast data from a multicast group to one or more ports.

The **destination** parameter specifies the IP address to which multicast group address data is forwarded.

The **interface** parameter specifies the interface over which multicast data is forwarded.

The static IGMP association identified by the **destination** and **interface** parameters must not already exist.

The **port** parameter specifies the ports through which multicast data is forwarded. If any of the ports specified in the port list are not valid ports for the specified interface, an error message is displayed. An empty port list can be specified by giving no value to the **port** parameter. Ports may be added later with the **add ip igmp destination** command.

If **all** is specified or if the **port** parameter is not entered, all ports that belong to that interface forward multicast data.

Since static IGMP associations are identified by the combination of destination and interface, one destination or interface may belong to several different associations. Also, ports may belong to several associations if there are overlapping VLANs. There is no conflict with existing standard (dynamic) IGMP hosts: if a new static association's port already has a dynamic IGMP host, the new static entry replaces it.

IGMP destinations added with this command never time out. They can be removed with the **destroy ip igmp destination** command.

Examples

To forward multicast data to 224.1.2.3 out ports 1 to 4 using *vlan1*, use the command:

```
cre ip igmp des=224.1.2.3 int=vlan1 po=1-4
```

Related Commands

add ip igmp destination
delete ip igmp destination
destroy ip igmp destination
show ip igmp

create ip mvr

Syntax

```
CREate IP MVR VLAN=1..4094 SOurceport=port-list
   RECeiverport=port-list [IMTLeave=port-list]
   [MODe={DYnamic|COMpatible}]
```

where *port-list* is a port number, a range of port numbers (specified as *n-m*), or a comma-separated list of port numbers and/or ranges. Port numbers start at 1 and end at m, where *m* is the highest numbered Ethernet switch port, including uplink ports.

Description

This command creates Multicast VLAN Registration on the switch.

The **vlan** parameter specifies the VLAN Identifier that the multicast VLAN is associated with.

The **sourceport** parameter specifies the uplink (source) ports that send and receive multicast data to and from the multicast VLAN. All source ports must belong to a single multicast VLAN.

The **receiverport** parameter specifies the port(s) that receives multicast data when they are members of the multicast group. The receiver ports cannot belong to the multicast VLAN.

The **imtleave** parameter specifies the ports on which the Immediate Leave feature is enabled. If this parameter is specified, the receiver ports immediately leave the multicast group as soon an IGMP Leave message is received by the switch on that port. Otherwise, the switch sends an IGMP query on the port and waits for the IGMP group membership reports when it receives an IGMP Leave message. If no reports are received within the configured IGMP time period (see the **set ip igmp** command on page 75), the receiver port leaves the multicast group. The port numbers specified must be members of the **receiverport** list. If the **imtleave** parameter is not specified, the function is disabled on all receiver ports.

The **mode** parameter specifies the mode of the MVR operation. If **dynamic** is specified, IGMP reports are sent out through the source ports of the multicast VLAN. If **compatible** is specified, IGMP reports are not sent out. The default is **dynamic**.

Examples

To create MVR, use the command:

```
cre ip mvr vlan=22 so=8,9 rec=1-5, 6-8 imtl=2,4
```

Related Commands

destroy ip mvr
set ip mvr
show ip mvr

delete igmp filter

Syntax `DELete IGMP FILter=`*`filter-id`* `ENTry={1..65535|ALL}`

where *filter-id* is a decimal number from 1 to 99

Description This command deletes the specified entry or all entries from an IGMP filter.

The **filter** parameter specifies the number of the filter that the entry belongs to. A filter with the specified number must already exist.

The **entry** parameter specifies the entry to delete. The specified entry must exist. If you specify **all**, then all entries are deleted from the filter.

Examples To delete entry 21 from filter 5, use the command:

```
del igmp fil=5 entry=21
```

Related Commands
add igmp filter
create igmp filter
destroy igmp filter
set igmp filter
show igmp filter

delete igmpsnooping routeraddress

Syntax `DELete IGMPSNooping ROUTERAddress=`*`ipaddr-list`*

where *ipaddr-list* is a reserved IP multicast address in dotted decimal notation, or a comma-separated list of reserved IP multicast addresses

Description This command deletes reserved IP multicast addresses from the list of router multicast addresses. The IP address specified must be from 224.0.0.1 to 224.0.0.255. This command is only valid if IGMP Snooping router mode is set to IP with the **set igmpsnooping routermode** command.

Examples To remove addresses 224.0.0.25 and 224.0.0.86 from the router multicast address list, use the command:

```
del igmpsn routera=224.0.0.25,224.0.0.86
```

Related Commands
add igmpsnooping routeraddress
set igmpsnooping routermode
show igmpsnooping routeraddress

delete igmpsnooping vlan

Syntax

```
DELete IGMPSNooping vlan={vlan-name|1..4094}
   routerport=port-list
```

where

- *vlan-name is* a unique name from 1 to 32 characters. Valid characters are uppercase and lowercase letters, digits, the underscore, and hyphen. The *vlan-name* cannot be a number or **all**.
- *port-list* is a port number, range (specified as *n-m*), or comma-separated list of numbers and/or ranges. Port numbers start at 1 and end at *m*, where *m* is the highest numbered Ethernet switch port.

Description

This command stops IGMP snooping from treating ports as multicast router ports. The switch stops forwarding IGMP messages and other IP multicast traffic out these ports.

The **vlan** parameter specifies the VLAN for which the ports are no longer to be treated as multicast router ports. There is no default.

The **routerport** parameter specifies the ports in the VLAN that no longer have multicast routers attached to them. There is no default.

Examples

To stop port 3 in vlan2 from being a multicast router port, use the command:

```
del igmpsn vlan=2 routerp=3
```

Related Commands

add igmpsnooping routeraddress
add igmpsnooping vlan
set igmpsnooping routermode
show igmpsnooping
show igmpsnooping routeraddress

delete ip igmp destination

Syntax

```
DELete IP IGMP DEStination=ipaddress INTerface=interface
   POrt={ALL|port-list}
```

where:

- *ipaddress* is an existing IGMP group destination address.
- *interface* is the name of the interface over which multicast data is forwarded. This must be a VLAN interface.
- *port-list* is a port number, a range of port numbers (specified as *n-m*), or a comma- separated list of port numbers and/or ranges. Port numbers start at 1 and end at m, where *m* is the highest numbered Ethernet port, including uplink ports.

Description

This command deletes ports from a static multicast group. Multicast data from the multicast group are no longer forwarded out the port. The static association identified by the **destination** and **interface** parameters must exist for this command to succeed.

When ports specified in the port list are not assigned to this static association, an error message is displayed. When the last port is removed, the static association still exists, although it has no functionality until ports are added again. To destroy the entire static association, use the **destroy ip igmp destination** command.

Examples

To remove ports 1-4 from the list of ports through which multicast data for 224.1.2.3 is forwarded over *vlan1*, use the command:

```
del ip igmp des=224.1.2.3 int=vlan1 po=1-4
```

Related Commands

add ip igmp destination
create ip igmp destination
destroy ip igmp destination
show ip igmp

delete ip mvr

Syntax `DELete IP MVR VLAN=1..4094 GROupaddress=`*`ipadd`*`-[`*`ipadd`*`]`

where *ipadd* is an IP address in dotted decimal notation

Description This command deletes an MVR IP multicast group address or range of addresses on a switch.

The **vlan** parameter specifies the VLAN Identifier that the multicast VLAN is associated with.

The **groupaddress** parameter specifies the multicast group IP address or range of IP addresses that belong to the multicast VLAN.

Examples To delete a multicast IP group address from a multicast VLAN, use the command:

```
del ip mvr vlan=22 gro=230.1.1.1
```

Related Commands
add ip mvr
show ip mvr

delete pim bsrcandidate

Syntax `DELete PIM BSRCandidate`

Description This command stops the switch from acting as a bootstrap router candidate in the PIM-SM domain.

Examples To stop the switch from acting as a bootstrap router candidate, use the command:

```
del pim bsrc
```

Related Commands
add pim bsrcandidate
disable pim
show pim
show pim bsrcandidate

delete pim interface

Syntax `DELete PIM INTerface=`*`interface`*

where *interface* is an interface name formed by concatenating a Layer 2 interface type, an interface instance, and optionally a hyphen followed by a logical interface number from 0 to 15. If a logical interface is not specified, 0 is assumed.

Description This command deletes the specified interface from the PIM interface list on the switch, stops all PIM processes on the interface, and deletes all routing information generated by the interface. Valid interfaces are:

- VLAN (such as vlan1, vlan1-1)

To see a list of current interfaces, use the **show interface** command, or the **show pim interface** command. Note that multihomed interfaces must specify the logical interface number (e.g. ppp1-1).

Examples To delete interface vlan2 from PIM interface list, use the command:

```
del pim int=vlan2
```

Related Commands

add pim interface
disable pim
show pim
show pim interface

delete pim rpcandidate

Syntax

```
DELete PIM RPCandidate[=rp-address] GROup=group-address
   [MASK=ipaddress]
```

where:

- *group-address* is the IP address of the multicast group in dotted decimal notation.
- *ipaddress* is an IP address in dotted decimal notation.
- *rp-address* is an IP address in dotted decimal notation.

Description

This command deconfigures the switch from acting as a rendezvous point candidate for a multicast group.

The **rpcandidate** parameter is the IP address of the rendezvous point for the multicast group when it is specified with a value. This option can be used to remove a static RP mapping.

The **mask** parameter specifies the mask for the multicast group address specified with the **group** parameter. This is useful when deconfiguring multiple multicast groups with a common rendezvous point (RP). The default mask is 255.255.255.255.

Examples

To stop the switch from advertising itself as an RP candidate for multicast group 224.1.1.98, use the command:

```
del pim rpc gro=224.1.1.98
```

Related Commands

add pim rpcandidate
disable pim
show pim
show pim rpcandidate

destroy igmp filter

Syntax `DESTroy IGMP FILter=`*`filter-id`*

where *filter-id* is a decimal number from 1 to 99

Description This command destroys an IGMP filter and all entries in the filter. IGMP filters control a port's membership of multicast groups by filtering incoming IGMP messages received from hosts attached to the port.

The **filter** parameter specifies the number of an existing filter to destroy.

You should remove the filter from any ports before you destroy the filter. Use the **show switch port** command to see which ports the filter is applied to, and the **set switch port** command to remove the filter.

Examples To destroy filter 6, use the command:

```
des igmp fil=6
```

Related Commands
add igmp filter
create igmp filter
delete igmp filter
set igmp filter
show igmp filter

destroy ip igmp destination

Syntax `DESTroy IP IGMP DEStination=`*`ipaddress`* `INTerface=`*`interface`*

where:

- *ipaddress* is an existing IGMP group destination address.
- *interface* is the name of the interface over which multicast data is forwarded.

Description This command destroys a static IGMP association. It is not necessary to delete the ports first. The static IGMP association identified by the **destination** and **interface** parameters must already exist for this command to succeed.

Examples To stop the switch forwarding all multicast data for 224.1.2.3 over *vlan1*, use the command:

```
dest ip igmp des=224.1.2.3 int=vlan1
```

Related Commands
add ip igmp destination
create ip igmp destination
delete ip igmp destination
show ip igmp

destroy ip mvr

Syntax `DESTroy IP MVR VLAN=1..4094`

Description This command removes MVR from a switch.

The **vlan** parameter specifies the VLAN Identifier with which the multicast VLAN is associated.

Examples To remove MVR, use the command:

```
dest ip mvr vlan=22
```

Related Commands **create ip mvr**
set ip mvr
show ip mvr

disable igmpsnooping

Syntax `DISable IGMPSNooping`

Description This command disables IGMP snooping on the switch. IGMP snooping is enabled by default. Note that multicast packets flood the VLAN when IGMP snooping is disabled.

Disabling IGMP snooping may be useful when filters are used extensively because IGMP snooping uses a Layer 3 filter. When IGMP snooping is disabled, this filter becomes available.

Note that IGMP snooping is independent of IGMP, which is disabled by default.

Examples To disable IGMP snooping, use the command:

```
dis igmpsn
```

Related Commands
disable ip igmp interface
enable igmpsnooping
enable ip igmp
enable ip igmp interface
show ip igmp
show igmpsnooping

disable ip igmp

Syntax `DISable IP IGMP`

Description This command disables IGMP on the switch so that multicast routing stops immediately. IGMP is disabled by default. IGMP snooping is enabled by default and is independent of IGMP.

Examples To disable the IGMP module, use the command:

```
dis ip igmp
```

Related Commands
disable ip igmp interface
enable ip igmp
show ip igmp

disable ip igmp allgroup

Syntax `DISable IP IGMP ALLGroup=[`*`port-list`*`|ALL]`

where *port-list* is a port number, a range of port numbers (specified as *n-m*), or a comma separated list of port numbers and/or ranges. Port numbers start at 1 and end at m, where *m* is the highest numbered Ethernet switch port, including uplink ports.

Description This command disables the specified port or ports from acting as a router port. Once disabled, the port no longer receives MARL entries when the device receives an IGMP report, query, or multicast data over any other port.

Example To prevent ports 1, 5, and 7 from acting as an all-group entry, use the command:

```
dis ip igmp allg=1,5,7
```

Related Commands **enable ip igmp allgroup**

disable ip igmp debug

Syntax `DISable IP IGMP DEBug`

Description This command disables all IGMP debugging messages and resets the **destination** and **sourceipaddress** parameters set with the **enable ip igmp debug** command to **all**. Debugging is disabled by default.

Examples To disable all IGMP debugging messages and reset the IGMP debug message filters for all, use the command:

```
dis ip igmp deb
```

Related Commands **show ip igmp debug**

disable ip igmp interface

Syntax `DISable IP IGMP INTerface=`*`interface`*

where *interface* is an interface name formed by concatenating a Layer 2 interface type, an interface instance, and optionally a hyphen followed by a logical interface number from 0 to 15. If a logical interface is not specified, 0 is assumed.

Description This command disables IGMP on an IP interface. Valid interfaces are:

- VLAN (such as vlan1, vlan1-1)

To see a list of current valid interfaces, use the **show interface** command.

Disabling IGMP on an IP interface or a logical interface will disable IGMP on all logical interfaces associated with the IP interface.

Examples To disable IGMP on interface vlan2, use the command:

```
dis ip igmp int=vlan2
```

Related Commands

disable ip igmp
enable ip igmp interface
set ip igmp interface
show ip igmp

disable ip mvr

Syntax `DISable IP MVR`

Description This command disables MVR. MVR must be currently enabled. The default is disabled.

Examples To disable MVR, use the command:

```
dis ip mvr
```

Related Commands **enable ip mvr**

disable ip mvr debug

Syntax `DISable IP MVR DEBug={ALL|JOInt|LEAVe|MARL}`

Description This command disables debugging messages when specific actions are taken. The current debug option may or may not be disabled. The default is disabled.

If **all** is specified, all debugging on all ports is disabled.

If **joint** is specified, debugging of joint messages is disabled.

If **leave** is specified, debugging of leave messages is disabled.

If **marl** is specified, all debugging of the MARL table is disabled.

Examples To disable debugging joint messages on the multicast VLAN, use the command:

```
dis ip mvr deb=joi
```

Related Commands **enable ip mvr debug**

disable pim

Syntax `DISable PIM`

Description This command disables PIM on the switch. PIM multicast routing stops but PIM configurations remain intact. PIM is disabled by default.

Examples To disable PIM on the switch, use the command:

```
dis pim
```

Related Commands **delete pim bsrcandidate**
delete pim interface
delete pim rpcandidate
enable pim
show pim

disable pim bsmsecuritycheck

Syntax

```
DISable PIM BSMSecuritycheck
```

Description

This command disables PIM bootstrap message security checking. The switch stops checking that the source IP address of a bootstrap message is the expected address of the PIM neighbour.

Bootstrap message security checking is enabled by default. You may need to disable it when interoperating with some PIM implementations.

Examples

To disable PIM bootstrap message security checking, use the command:

```
dis pim bsms
```

Related Commands

enable pim
show pim config

disable pim debug

Syntax

```
DISable PIM DEBug={ALL|ASSert|BSR|C-Rp-adv|GRAft|HELlo|
   JOInt|REGister|STATerefresh}[,...]
```

Description

This command disables the debugging option. The option must currently be enabled. PIM debugging is disabled by default.

The **debug** parameter specifies which debugging options are to be disabled. The value of this parameter is a single option or a comma-separated list of options. The debugging that results from each of the options is shown in with the **disable pim debug** command on page 65.

Examples

To disable all PIM debugging, use the command:

```
dis pim deb=all
```

Related Commands

enable pim debug
show pim debug

enable igmpsnooping

Syntax `ENAble IGMPSNooping`

Description This command enables IGMP snooping on the switch. IGMP snooping is enabled by default. IGMP snooping can be enabled only when a free Layer 3 filter is available.

Note that IGMP snooping is independent of IGMP, which is disabled by default.

Examples To enable IGMP snooping, use the command:

```
ena igmpsn
```

Related Commands
disable igmpsnooping
disable ip igmp
disable ip igmp interface
enable ip igmp
enable ip igmp interface
show ip igmp
show igmpsnooping

enable ip igmp

Syntax `ENAble IP IGMP`

Description This command enables IGMP on the switch. IGMP is disabled by default. IGMP snooping is enabled by default and is independent of IGMP.

Examples To enable IGMP, use the command.

```
ena ip igmp
```

Related Commands
disable ip igmp
enable ip igmp interface
show ip igmp

enable ip igmp allgroup

Syntax `ENAble IP IGMP ALLGroup=[`*`port-list`*`|ALL]`

where *port-list* is a port number, a range of port numbers (specified as *n-m*), or a comma separated list of port numbers and/or ranges. Port numbers start at 1 and end at m, where *m* is the highest numbered Ethernet switch port, including uplink ports.

Description This command enables one or more ports to act like a router port. All ports are allowed to be a router port by default, so this command re-enables a port as a router port if it has previously been disabled with the **disable ip igmp allgroup** command.

Example To enable ports 1, 5, and 7 to act as an all-group entry, use the command:

```
ena ip igmp allg=1,5,7
```

Related Commands **disable ip igmp allgroup**
show ip igmp

enable ip igmp debug

Syntax
```
ENAble IP IGMP DEBug [DEStination={ALL|ipaddress}]
   [SOURCEipaddress={ALL|ipaddress2}]
```

where:

- *ipaddress* is an IGMP group destination address.
- *ipaddress2* is the IP address of a host that responds to IGMP queries.

Description This command enables IGMP debugging of destination and source IP addresses. Debugging is disabled by default.

The **destination** parameter specifies the destination multicast group address for debugging. The default is **all**.

The **sourceipaddress** parameter specifies the host IP address responding to IGMP queries. The default is **all**.

If **destination** and **sourceipaddress** are both specified, debug messages that match both parameters are displayed. Some debug messages are displayed before the packet is fully decoded, and are unable to be filtered.

Examples To enable debugging information relating to IGMP host 10.41.0.22, use the command:

```
ena ip igmp deb source=10.41.0.22
```

To show all IGMP debug messages, use the command:

```
ena ip igmp deb
```

Related Commands **show ip igmp debug**

enable ip igmp interface

Syntax `ENAble IP IGMP INTerface=`*`interface`*

where *interface* is an interface name formed by concatenating a Layer 2 interface type, an interface instance, and optionally a hyphen followed by a logical interface number from 0 to 15. If a logical interface number is not specified, 0 is assumed.

Description This command enables IGMP on an IP interface. Valid interfaces are:

- VLAN (such as vlan1, vlan1-1)

To see a list of current valid interfaces, use the **show interface** command. Note that IGMP does not operate on local interfaces.

Enabling IGMP on an IP interface or a logical interface will enable IGMP on all logical interfaces associated with the IP interface.

Examples To enable IGMP on vlan2 interface, use the command:

```
ena ip igmp int=vlan2
```

Related Commands
disable ip igmp interface
enable ip igmp
set ip igmp interface
show ip igmp

enable ip mvr

Syntax `ENAble IP MVR`

Description This command enables MVR. MVR must be currently disabled. The default is disabled.

Examples To enable MVR, use the command:

```
ena ip mvr
```

Related Commands
disable ip mvr

enable ip mvr debug

Syntax `ENAble IP MVR DEBug={ALL|JOInt|LEAVe|MARL}`

Description This command enables the display of debugging messages when specific actions are taken. The current debug option may or may not be enabled. The default is enabled.

If **all** is specified, debugging on all ports is enabled.

If **joint** is specified, debugging of joint messages is enabled.

If **leave** is specified, debugging of leave messages is enabled.

If **marl** is specified, debugging of the MARL table is enabled.

Examples To enable debugging of joint messages on the multicast VLAN, use the command:

```
ena ip mvr deb=joi
```

Related Commands **disable ip mvr debug**

enable pim

Syntax `ENAble PIM`

Description This command enables PIM routing on the switch. PIM is disabled by default. Any existing PIM configuration is activated after this command has been entered.

Examples To enable PIM routing, use the command:

```
ena pim
```

Related Commands
add pim bsrcandidate
add pim interface
add pim rpcandidate
disable pim
set pim interface
set pim
show pim

enable pim bsmsecuritycheck

Syntax

```
ENAble PIM BSMSecuritycheck
```

Description

This command enables PIM bootstrap message security checking, which checks that the source IP address of a bootstrap message is the expected address of the PIM neighbour.

This checking is enabled by default. You may need to disable it when interoperating with some PIM implementations.

Examples

To enable PIM bootstrap message security checking, use the command:

```
ena pim bsms
```

Related Commands

disable pim bsmsecuritycheck
show pim config

enable pim debug

Syntax

```
ENAble PIM DEBug={ALL|ASSert|BSR|C-Rp-adv|GRAft|HELlo|
   JOInt|REGister|STATerefresh}[,...]
```

Description

This command enables debugging options. Debugging may or may not be enabled already. Debugging information is sent to the port or Telnet session from which the command was entered. All PIM debugging is disabled by default.

The **debug** parameter specifies which debugging options are to be enabled. The value of this parameter is a single option or a comma-separated list of options. The following table describes the debugging options.

Parameter	Description
ALL	All debug options.
ASSert	PIM Assert packets
BSR	PIM Bootstrap packets (Sparse Mode only)
C-Rp-adv	PIM Candidate-RP-Advertisement (Sparse Mode only)
GRAft	PIM Graft packets (Dense Mode only)
HELlo	PIM Hello packets
JOInt	PIM Join/Prune packets
REGister	PIM Register and Register Stop packets (Sparse Mode only)
STATerefresh	PIM State Refresh packets (Dense Mode only)

Examples

To enable debugging of PIM hello and join/prune messages, use the command:

```
ena pim deb=hello,joi
```

Related Commands

disable pim debug

purge pim

Syntax `PURge PIM`

Description This command purges all configuration information relating to the PIM multicast routing module, and reinitialises the data structures used by the module. It also stops the current PIM operation. It should be used when first setting up the PIM module or when a major change is required.

Caution All current PIM configuration information will be lost. Use with extreme caution!

Related Commands
delete pim bsrcandidate
delete pim interface
delete pim rpcandidate
disable pim
disable pim debug
reset pim interface
show pim

reset pim interface

Syntax `RESET PIM INTerface=`*`interface`*

where *interface* is an interface name formed by concatenating a Layer 2 interface type, an interface instance, and optionally a hyphen followed by a logical interface number from 0 to 15. If a logical interface is not specified, 0 is assumed.

Description This command resets all timers, route information, and counters associated with the specified interface, and restarts all PIM processes for this interface as if this interface has just been added to PIM interface list. It also disables any enabled PIM debugging on the interface. Valid interfaces are:

- VLAN (such as vlan1, vlan1-1)

To see a list of current valid interfaces, use the **show interface** command, or the **show pim interface** command. Note that multihomed interfaces must specify the logical interface number (4e.g. ppp1-1).

Examples To reset the ppp0 interface, use the command:

```
reset pim int=ppp0
```

Related Commands
set pim interface
set pim
show pim
show pim interface

set igmp filter

Syntax

```
SET IGMP FILter=filter-id ENTry=1..65535
   [GROupaddress={ipadd|ipadd-ipadd}] [MSGType={QUEry|
   REPort|LEAVe}] [ACtion={INCLude|EXCLude}]
```

where:

- *filter-id* is a decimal number from 1 to 99.
- *ipadd* is an IP address in dotted decimal notation.

Description

This command modifies an entry in an IGMP filter. IGMP filters control a port's membership of multicast groups by filtering incoming IGMP messages from hosts attached to the port.

The **filter** parameter specifies the number of the filter that the entry belongs to. A filter with the specified number must already exist.

The **entry** parameter specifies the entry to modify. An entry with the specified number must already exist.

The **groupaddress** parameter specifies an IP multicast group address or a range of IP multicast group addresses to match. Set **groupaddress** to:

- 0.0.0.0 to filter IGMP general query messages
- a multicast address or a range of multicast addresses to filter IGMP group-specific query messages, report messages, and leave messages.

The **msgtype** parameter specifies the type of incoming IGMP message to match. If you specify **query**, the filter will match IGMP general and group-specific query messages. If you specify **report**, the filter will match IGMP report messages. If you specify **leave**, the filter will match IGMP leave messages. The default is **report**.

The **action** parameter specifies the action to take when an IGMP message with a message type matching **msgtype** and a group address matching **groupaddress** is received. If you specify **include**, the message is processed as normal by IGMP. If you specify **exclude**, the message is excluded from processing by IGMP, and the packet is discarded. The default is **include**.

If an IGMP filter contains at least one entry for a particular IGMP message type, then messages of the same type for group addresses that do not match any entries in the filter are implicitly excluded and the packets are discarded.

Examples

To change the group address for entry 12 in filter 6 to the range 229.1.1.2 to 230.1.2.3, use the command:

```
set igmp fil=6 ent=12 gro=229.1.1.2-230.1.2.3
```

To change entry 1 in filter 2 to accept Membership Reports for multicast group addresses matching the entry's group address range, use the command:

```
set igmp fil=2 ent=1 ac=incl
```

Related Commands

add igmp filter
create igmp filter
delete igmp filter
destroy igmp filter
show igmp filter

set igmpsnooping vlan

Syntax

```
SET IGMPSNooping VLAN={vlan-name|1..4094|ALL}
   [Fastleave={ON|OFF|YES|NO|True|False}]
   [QUErysolicit={OFF|NO|False|ON|YES|True}]
```

where *vlan-name is* a unique name from 1 to 32 characters. Valid characters are uppercase and lowercase letters, digits, the underscore, and hyphen. The *vlan-name* cannot be a number or **all**.

Description

This command enables or disables Fast Leave processing and query solicitation for IGMP Snooping.

The **vlan** parameter specifies the VLAN on which the specified feature is to be enabled or disabled. The default is **all**.

The **fastleave** parameter specifies whether Fast Leave processing is enabled or disabled. If you specify **on**, **yes** or **true** then Fast Leave processing is enabled on the specified VLAN or all VLANs. If you specify **off**, **no** or **false** then Fast Leave processing is disabled on the specified VLAN or all VLANs. Note that Fast Leave should not be configured on a port that has multiple hosts attached because it may adversely affect multicast services to some hosts. See "Fast Leave" on page 24 for more information. The default is **off**.

This command deprecates the following command, which is still valid:

```
set igmpsnooping fastleave={on|yes|true|off|no|false}
   [interface=vlan]
```

The **querysolicit** parameter specifies whether query solicitation is enabled or disabled. Query solicitation minimises loss of multicast data after a topology change on networks that use spanning tree (STP, RSTP, or MSTP) for loop protection and IGMP snooping. See "Query Solicitation" on page 24 for more information. The default is **on** for the root bridge in an STP topology and **off** for other switches.

Examples

To enable IGMP Snooping Fast Leave processing on 'vlan2', use the command:

```
set igmpsn vlan=vlan2 f=on
```

Related Commands

disable igmpsnooping
enable igmpsnooping
set igmpsnooping routermode
show igmpsnooping

set igmpsnooping routermode

Syntax

```
SET IGMPSNooping ROUTERMode={ALL|DEFault|IP|
   MULTICAstrouter|NONE}
```

Description

This command determines the kinds of packets that IGMP snooping uses to indicate that a router is attached to a port. For more information, see "Downstream routers" on page 23.

The **all** option specifies that all reserved multicast addresses (i.e. 224.0.0.1 to 224.0.0.255) are treated as router multicast addresses.

The **default** option specifies that the following multicast addresses are treated as multicast router addresses:

Router Type	Multicast Address
IGMP Query	224.0.0.1
All routers on this subnet	224.0.0.2
DVMRP Routers	224.0.0.4
All OSPFIGP routers	224.0.0.5
OSPFIGP designated routers	224.0.0.6
RIP2 routers	224.0.0.9
All PIM routers	224.0.0.13
All CBT routers	224.0.0.15

The **ip** option starts with the addresses specified by the currently-set option and lets users add or remove addresses with the **add igmpsnooping routeraddress** and **delete igmpsnooping routeraddress** commands.

The **multicastrouter** option specifies that the following addresses are treated as router multicast addresses:

- DVMRP Routers, 224.0.0.4
- All PIM routers, 224.0.0.13

The **none** option specifies that the switch does not create router ports.

Examples

To allow the switch to treat all reserved multicast addresses as router multicast addresses, use the command:

```
set igmpsn routerm=all
```

Related Commands

add igmpsnooping routeraddress
delete igmpsnooping routeraddress
show igmpsnooping routeraddress

set ip igmp

Syntax

```
SET IP IGMP [LMQi=1..255] [LMQC=1..5]
   [QUEryinterval=1..65535] [QUERYREsponseinterval=1..255]
   [ROBustness=1..5] [TIMEOut=1..65535]
```

Description This command sets operational timers and thresholds for IGMP.

Caution The defaults for these timers suit most networks. Changing them to inappropriate values can cause IGMP to function in undesirable ways. System administrators should change timer values based on a sound understanding of their interaction with other devices in the network.

The **lmqi** parameter specifies the Last Member Query Interval (in 1/10 secs), which is the Max Response Time inserted into Group-Specific Queries sent in response to Leave Group messages. It is also the amount of time between Group-Specific Query messages. The default is 10 (1 second).

The **lmqc** parameter specifies the Last Member Query Count, which is the number of Group-Specific Queries sent before the switch assumes there are no local members. The default is the same as **robustness** value.

The **queryinterval** parameter specifies the seconds of the interval between IGMP Host Membership Queries if this switch is elected the designated router for the LAN. If the switch is not the IGMP designated router, it ignores this parameter. The default is 125.

The **queryresponseinterval** parameter specifies the Max Response Time (in 1/10 second) inserted into the periodic General Queries. The default is 100 (10 seconds).

The **robustness** parameter specifies the Robustness Variable that allows tuning for the expected packet loss on a subnet. If a subnet is expected to be lossy, the Robustness Variable may be increased. IGMP is robust to (Robustness Variable - 1) packet losses. The Robustness Variable *must not* be zero and *should not* be 1. The default is 2.

The **timeout** parameter specifies the longest interval in seconds that a group remains in the local multicast group database without the switch (designated router or not) receiving a Host Membership Report for this multicast group. This **timeout** parameter is used by all IGMP routers to maintain their group membership databases. The default is 260. If a value is specified for **queryinterval** without specifying a value for **timeout**, **timeout** is calculated as (2 * **queryinterval**) + 10. The added 10 seconds is the default **queryresponseinterval** that hosts use when sending Host Membership Reports. When a timeout interval is specified, it overrides a calculated value.

Examples To set the IGMP query interval to 180s (3 minutes), use the command:

```
set ip igmp que=180
```

Related Commands

disable ip igmp
disable ip igmp interface
enable ip igmp
enable ip igmp interface
set ip igmp interface
show ip igmp

set ip igmp interface

Syntax

```
SET IP IGMP INTerface=interface QUERYtimeout={NONE|0|
   1..65535}
```

where:

- *interface* is an interface name formed by concatenating a Layer 2 interface type, an interface instance, and optionally a hyphen followed by a logical interface number from 0 to 15. If a logical interface is not specified, 0 is assumed.

Description

This command enables the monitoring of incoming IGMP general query messages on an interface, and generates a log message and an SNMP trap if an IGMP general query message is not received on the interface within a specified time interval.

The **interface** parameter specifies the IP interface to monitor for IGMP general query messages. Valid interfaces are:

- VLAN (such as vlan1, vlan1-1)

Modifying IGMP on an IP interface or a logical interface will change the behaviour of IGMP on all logical interfaces associated with the IP interface.

The **querytimeout** parameter specifies the maximum expected time interval, in seconds, between successive IGMP general query messages arriving on the interface. If you specify **none** or **0**, monitoring is disabled. If you specify a non-zero time interval, a log message and an igmpGeneralQueryNotReceivedEvent SNMP trap is generated if an IGMP general query message is not received on the interface within the time interval. Monitoring is only active when:

- IGMP is enabled globally
- IGMP is enabled on the interface
- the interface is active

The default is **none**.

Examples

To set the maximum time period allowed between successive IGMP general query messages on interface vlan2 to 120 seconds, use the command:

```
set ip igmp int=vlan2 query=120
```

Related Commands

disable ip igmp
disable ip igmp interface
enable ip igmp
enable ip igmp interface
set ip igmp
show ip igmp

set ip mvr

Syntax

```
SET IP MVR VLAN=1..4094 [IMTLeave=port-list]
   [MODe={DYnamic|COMpatible}] [RECeiverport=port-list]
   [SOurceport=port-list]
```

where *port-list* is a port number, a range of port numbers (specified as *n-m*), or a comma-separated list of port numbers and/or ranges. Port numbers start at 1 and end at *m*, where m is the highest numbered Ethernet switch port.

Description

This command modifies MVR on a switch.

The **vlan** parameter specifies the VLAN Identifier with which the multicast VLAN is associated.

The **imtleave** parameter specifies the ports on which the Immediate Leave feature is enabled. If this parameter is specified, the receiver ports immediately leave the multicast group as soon an IGMP Leave message is received by the switch on that port. Otherwise, the switch sends an IGMP query on the port and waits for the IGMP group membership reports when it receives an IGMP Leave message. If no reports are received within the IGMP timeout period (see the **set ip igmp** command on page 75), the receiver port leaves the multicast group. The port numbers specified must be members of the **receiverport** list.

The **mode** parameter specifies the mode of the MVR operation. If **dynamic** is specified, IGMP reports are sent out through the source ports of the multicast VLAN. If **compatible** is specified, IGMP reports are not sent.

The **receiverport** parameter specifies a receiver port that receives multicast data when it is a member of the multicast group. The receiver ports cannot belong to the multicast VLAN.

The **sourceport** parameter specifies the uplink (source) ports that send and receive multicast data to and from the multicast VLAN. All source ports must belong to a single multicast VLAN.

Examples

To modify MVR, use the command:

```
set ip mvr vlan=22 so=8,9 rec=1-5, 6-8 imtl=2,4
```

Related Commands

create ip mvr
destroy ip mvr
show ip mvr

set pim

Syntax

```
SET PIM [ADVinterval={10..15000|DEFault}]
   [BSMinterval={10..15000|DEFault}]
   [JPInterval={1..65535|DEFault}]
   [KEEPalivetime={10..65535|DEFault}]
   [PRObetime={1..65535|DEFAULT}]
   [PRUNEholdtime={1..65535|DEFault}]
   [SOURCealivetime={10..65535|DEFault}]
   [SRINterval={10..255|DEFault}]
   [SUPPressiontime={1..65535|DEFault}]
```

Description This command sets timers for PIM operations.

Caution The defaults for these timers suit most networks. Changing them to inappropriate values may cause PIM to function in undesirable ways. System administrators should change these timer values based on a sound understanding of their interaction with other devices in the network.

The **advinterval** parameter specifies the seconds of the interval at which the switch sends C-RP-Advertisements. The default is 60 seconds. This timer applies to PIM-SM only.

The **bsminterval** parameter specifies the seconds of the interval at which the switch sends bootstrap messages when it is the bootstrap switch in the domain. The default is 60 seconds. This timer applies to PIM-SM only.

The **jpinterval** parameter specifies the upstream join timer in seconds. This is the interval at which PIM join/prune messages are sent. For proper operation, a maximum value of 18000 seconds is recommended. The default is 60 seconds.

The **keepalivetime** parameter specifies the seconds that the join state for a particular source and group pair is maintained in the absence of data for that pair. The default is 210 seconds.

The **probetime** interval specifies the register probe time in seconds. This is the time the DR waits for another register stop message after sending a null register message to the RP. If it does not receive a register stop message in this time, it resumes registering data packets to the RP. The default is 5 seconds. This timer applies to PIM-SM only.

The **pruneholdtime** parameter specifies the seconds that the prune state is maintained. This time is used in prune messages to let upstream neighbours know how long to hold the prune state. It is also used as the prune limit timer for suppressing prunes if a prune message has already been sent. The default is 210 seconds. This timer applies to PIM-DM only.

The **sourcealivetime** parameter specifies the seconds that a switch acting as a state refresh originator is active in the absence of data packets from the source. The default is 210 seconds. This timer applies to PIM-DM only.

The **srinterval** parameter specifies the seconds of the interval at which this switch sends state refresh messages, if it is configured to be state refresh capable, and becomes a state refresh originator (in general, this means having a directly connected source). The default is 60 seconds. This timer applies to PIM-DM only.

The **suppressiontime** parameter specifies the register suppression time. This determines the interval at which the sender's DR sends null register messages to the group's RP to tell it to send another register stop message if it still does not need the data to be registered and sent to it. The default is 60 seconds. This timer applies to PIM-SM only.

Examples To set the join/prune message interval to 90 seconds, use the command:

```
set pim jpi=90
```

Related Commands

enable pim
set pim interface
show pim
show pim bsrcandidate
show pim counters
show pim debug
show pim interface
show pim neighbour
show pim route
show pim rpcandidate
show pim rpset
show pim timer

set pim log

Syntax

```
SET PIM LOG=[NONE|STAtus|ERRor|ALL] [TRap=[NONE|STAtus|
   ERRor|ALL]]
```

Description This command applies to PIM-SM only and sets the type of logging for status PIM log messages, error messages and/or sending of SNMP traps for certain error conditions.

The **log** parameter specifies whether status, error, or all log messages should be generated. The default is status.

The **trap** parameter specifies whether status, error, or all traps should be generated.

Related Commands

show pim debug

set pim bsrcandidate

Syntax

```
SET PIM BSRCandidate [HAShmasklength=0..32]
   [INTerface=interface] [PREFerence=0..255]
```

where *interface* is the name of the interface over which multicast data is forwarded. The interface can be either a VLAN (e.g. vlan1) or a local interface (e.g. local1).

Description

This command sets the switch's Bootstrap Router Candidate preference.

The **hashmasklength** parameter specifies the number of bits of the group number to use when selecting a rendezvous point (RP) candidate if this switch becomes the BSR. A higher number increases the spread of groups across RPs. The default is 30.

Note that software release versions prior to 2.7.3 did not correctly support the PIM hash mask length option. As a result, the RP selection calculation differs between this release and release versions prior to 2.7.3. If a network contains switches running a mixture of versions, this leads to incorrect forwarding behaviour. To avoid this issue, either ensure that all devices on the network correctly support the hash mask length option (recommended), or ensure that the following **both** hold:

- The hash mask length option on all BSR candidates is configured to 4 bits. This implies that all BSR candidates must be running 2.7.3 or later.
- All RP candidates use a common prefix of 224.0.0.0/240.0.0.0. This has the side effect of collapsing all groups to use a single PIM RP.

The **interface** parameter specifies an interface for the switch to use when advertising itself as a candidate bootstrap router. The IP address of this interface is advertised by the switch. The interface supplied can be either a configured local interface or a configured VLAN interface. If the parameter is not specified, the switch instead advertises its first active IP interface.

The **preference** parameter specifies the preference for this switch to become the bootstrap router for the PIM-SM domain. A higher value indicates a greater preference.

Examples

To change the switch's candidate BSR preference to 100 and a hash mask length of 0, use the command:

```
set pim bsrc pref=100 hasmasklength=0
```

Related Commands

add pim bsrcandidate
delete pim bsrcandidate
show pim bsrcandidate

set pim interface

Syntax

```
SET PIM INTerface=interface[DRPriority=0..4294967295]
   [ELectby={DRPriority|IPaddress}]
   [HEllointerval={10..15000|DEFault|65535}] [MODe={Dense|
   Sparse}] [SRCapable={Yes|No}]
```

where *interface* is an interface name formed by concatenating a Layer 2 interface type, an interface instance, and optionally a hyphen followed by a logical interface number from 0 to 15. If a logical interface is not specified, 0 is assumed.

Description

This command sets parameters for the specified PIM interface. Valid interfaces are:

- VLAN (such as vlan1, vlan1-1)

To see a list of current valid interfaces, use the **show interface** command, or the **show pim interface** command. Note that multihomed interfaces must specify the logical interface number (e.g. ppp1-1).

he **drpriority** parameter specifies the preference for the switch to become the designated router (DR) on this interface when **electby**=**drpriority**. A higher value indicates a greater preference. The default is 1.

The **electby** parameter determines how the switch elects the designated router for this interface. If **drpriority** is specified, the interface transmits its drpriority in its hello messages, which allows DR election by priority. If **ipaddress** is specified, the switch does not transmit its DR priority, which causes election by IP address. The default is **drpriority**. Note that a switch with **electby**=**drpriority** may still elect by IP address when it does not receive DR priority in any one of its neighbours' hello messages. Election by DR priority is possible only when all routers on the interface supply their DR priority.

The **hellointerval** parameter specifies the interval at which the switch sends Hello messages from this interface. Setting the **hellointerval** parameter to 65535 results in a Hello message being sent with a hold time of 65535, which means "infinity". A router receiving this switch's Hello never expires this switch as a PIM neighbour. This can be useful on point-to-point links. The default is 30 seconds.

The **mode** parameter specifies the PIM operating mode for the interface. The default is **sparse**.

Ensure that all interfaces have the same mode setting unless the switch is a Multicast Border Router.

The **srcapable** parameter indicates if this interface is able to originate or process State Refresh messages. The default is **no**. This parameter applies to Dense Mode interfaces only.

Examples

To set the designated router priority for the interface vlan1 to 100, use the command:

```
set pim int=vlan1 drp=100
```

Related Commands

add pim interface
delete pim interface
enable pim

reset pim interface
show pim
show pim interface

set pim rpcandidate

Syntax

```
SET PIM RPCandidate GROup=group-address
   [INTerface=interface] [MASK=ipaddress]
   [PRIOrity=0..255]
```

where:

- *group-address* is the IP address of the multicast group in dotted decimal notation
- *ipaddress* is an IP address in dotted decimal notation
- *interface* is the name of a VLAN (e.g. vlan1) or a local interface (e.g. local1).

Description

This command sets the rendezvous point candidate priority for the specified multicast groups.

The **group** parameter specifies the multicast group or groups to which the switch is a rendezvous point candidate.

The **interface** parameter specifies an interface for the switch to use when advertising itself as the candidate rendezvous point for a multicast group. The IP address of the of this interface is advertised by the switch. The **interface** supplied can be either a configured local interface or a configured VLAN interface. If the parameter is not specified, the switch advertises its first active IP interface instead.

The **mask** parameter specifies the mask for the multicast group address specified in the **group** parameter. This is useful when configuring multiple multicast groups with a common rendezvous point (RP). The default mask is 255.255.255.255. The mask for a group cannot be modified.

The **priority** parameter specifies the preference for the switch to become the rendezvous point for the multicast group. A lower value indicates a higher priority. The default is **192**.

Note that the switch has the same values for **priority** for all multicast groups for which it is a rendezvous point candidate, so changing this switch's priority to be the RP for one group changes it for all groups.

Examples

To change the switch's RP candidate priority to 10 for the multicast group with address 224.1.1.98, use the command:

```
set pim rpc gro=224.1.1.98 prio=10
```

Related Commands

add pim rpcandidate
delete pim rpcandidate
show pim rpcandidate
show pim rpset

show igmp filter

Syntax `SHow IGMP FILter[=`*`filter-id`*`]`

where *filter-id* is a decimal number in the range 1 to 99

Description This command displays information about an IGMP filter or all IGMP filters (Figure 4, Table 1). If a **filter** is specified, only information about that filter is displayed.

Figure 4: Example output from the **show igmp filter** command

```
IGMP Filters
-------------------------------------------------------------------------------
No.   Entry  Group Address Range                Msg Type  Action         Matches
-------------------------------------------------------------------------------
1     224    224.1.2.3       - 224.1.2.3       Report    Exclude             10
      229    229.1.1.1       - 229.2.2.2       Leave     Include              2

   Reports  -  Recd:          80    Passed:          70    Dropped:          10
   Queries  -  Recd:           0    Passed:           0    Dropped:           0
   Leaves   -  Recd:           2    Passed:           2    Dropped:           0
-------------------------------------------------------------------------------
```

Table 1: Parameters in the output of the **show igmp filter** command

Parameter	Meaning
No.	The filter number.
Entry	The entry number of an entry in this filter.
Group Address Range	The multicast group address range for this entry.
Msg Type	The type of IGMP message being filtered by this entry; one of "Leave", "Query", or "Report".
Action	The action to take when an IGMP message matching the message type and group address of this entry is received.
Matches	The number of IGMP messages received that were matched by this entry.
Reports, Queries, Leaves	The total number of IGMP messages of the specified type that were received and processed on all the switch ports that this filter is attached to.
Recd	The number of IGMP messages of the specified type that were received on all the switch ports that this filter is attached to.
Passed	The number of IGMP messages of the specified type that were received and accepted on all the switch ports that this filter is attached to.
Dropped	The number of IGMP messages of the specified type that were received and discarded on all the switch ports that this filter is attached to.

Examples To display information about IGMP filter 3, use the command:

```
sh igmp fil=3
```

Related Commands

add igmp filter
create igmp filter
delete igmp filter
destroy igmp filter
set igmp filter

show igmpsnooping

Syntax `SHow IGMPSNooping [VLAN={`*`vlan-name`*`|1..4094}]`

where *vlan-name* is a unique name for the VLAN 1 to 32 characters long. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen.

Description This command displays information about IGMP snooping on a VLAN or VLANs (Figure 5, Table 2).

If a **vlan** is specified, only output for that VLAN is displayed.

Figure 5: Example output from the **show igmpsnooping** command

```
IGMP Snooping
------------------------------------------------------------
Status ........................... Enabled
Disabled All-groups ports ........ None

Vlan Name (vlan id) ..... default (1)
Fast Leave .............. On
Static Router Ports ..... None
Query Solicitation ...... Off
Group List ..............

  Group. 225.1.2.3               Entry timeout 268 secs
  Ports  16,19

  Group. 239.1.2.3               Entry timeout 180 secs
  Ports  21

Vlan Name (vlan id) ..... vlan2 (2)
Fast Leave .............. On
Group List ..............

  All Groups                     Entry timeout 255 secs
  Ports  13


Vlan Name (vlan id) ..... vlan3 (3)
Fast Leave .............. Off
Group List ..............

  No group memberships.
------------------------------------------------------------
```

Table 2: Parameters in output of the **show igmpsnooping** command

Parameter	Meaning
Status	Whether IGMP snooping is enabled.
Disabled All-groups ports	A list of ports that are disallowed from acting as an all-groups port.
VLAN Name (vlan id)	The name and VID of the VLAN where IGMP snooping is operating.
Fast Leave	Whether Fast Leave processing is enabled on this VLAN.

Table 2: Parameters in output of the **show igmpsnooping** command (cont.)

Parameter	Meaning
Static Router Ports	A list of ports that have been statically configured as multicast router ports. These are in addition to any ports that the switch dynamically determines are multicast router ports.
Query Solicitation	Whether query solicitation is enabled on this VLAN.
Group List	A list of multicast group memberships for this VLAN.
Group	Group multicast address.
All Groups	This entry lists ports that IGMP snooping has identified as members of all groups, for example, ports connected to routers.
Entry timeout	Time in seconds until the group's entry is deleted if no other IGMP messages for the group are seen.
Ports	A list of ports listening to this group.

Examples To display information about IGMP snooping, use the command:

```
sh igmpsn
```

To display information about IGMP snooping on VLAN 2, use the command:

```
sh igmpsn vlan=2
```

Related Commands

disable igmpsnooping
disable ip igmp
enable igmpsnooping
enable ip igmp
set igmpsnooping vlan
set ip igmp
show igmpsnooping counter
show igmpsnooping routeraddress

show igmpsnooping counter

Syntax `SHow IGMPSNooping COUnter [VLAN={`*`vlan-name`*`|1..4094}]`

where *vlan-name* is a unique name for the VLAN 1 to 32 characters long. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen.

Description This command displays IGMP snooping counters on a VLAN or VLANs (Figure 6, Table 3).

If a **vlan** is specified, only output for that VLAN is displayed.

Figure 6: Example output from the **show igmpsnooping counter** command

```
IGMP Snooping Counters
------------------------------------------------------------

Vlan Name=default (Vlan Id=1):

  inQuery ............ 817       badQuery ............. 0
  inV1Report ........... 0       badV1Report .......... 0
  inV2Report ........ 1265       badV2Report .......... 0
  inLeave ............. 0       badLeave ............. 0
  inRouterMsg ....... 4488       badRouterMsg ......... 0
  inTotal ........... 6570       badTotal ............. 0
------------------------------------------------------------
```

Table 3: Parameters in output of the **show igmpsnooping counter** command

Parameter	Meaning
inQuery	The number of IGMP membership query messages that were received by the interface.
badQuery	The number of IGMP membership query messages with errors that were received by the interface.
inV1Report	The number of IGMP Version 1 membership report messages that were received by the interface.
badV1Report	The number of IGMP Version 1 membership report messages with errors that were received by the interface.
inV2Report	The number of IGMP Version 2 membership report messages that were received by the interface.
badV2Report	The number of IGMP Version 2 membership report messages with errors that were received by the interface.
inLeave	The number of IGMP Version 2 Leave Group messages that were received by the interface.
badLeave	The number of IGMP Version 2 Leave Group messages with errors that were received by the interface.
inRouterMsg	The number of multicast packets received that were destined for 224.0.0.*x*. These messages indicate that a router is present on the port.
badRouterMsg	The number of multicast packets received with errors that were destined for 224.0.0.*x*.

Table 3: Parameters in output of the **show igmpsnooping counter** command (cont.)

Parameter	Meaning
inTotal	The total number of IGMP messages that were received by the interface.
badTotal	The total number of IGMP messages with errors that were received by the interface.

Examples

To display IGMP snooping counters for all VLANs, use the command:

```
sh igmpsn cou
```

To display IGMP snooping counters for VLAN 2, use the command:

```
sh igmpsn cou vlan=2
```

Related Commands

disable igmpsnooping
disable ip igmp
enable igmpsnooping
enable ip igmp
set ip igmp
show igmpsnooping
show igmpsnooping routeraddress

show igmpsnooping routeraddress

Syntax `SHow IGMPSNooping ROUTERAddress`

Description This command displays the current list of configured IP multicast router addresses configured on the switch.

Figure 7: Example output from the **show igmpsnooping routeraddress** command

```
IGMP Snooping Router Address
------------------------------------------------------------
IGMP Snooping Router Mode ......... default

Router Address List
------------------------------------------------------------
224.0.0.1       224.0.0.4       224.0.0.6       224.0.0.13
224.0.0.2       224.0.0.5       224.0.0.9       224.0.0.15
------------------------------------------------------------
```

Table 4: Parameters in output of the **show igmpsnooping routeraddress** command

Parameter	Meaning
IGMP Snooping Router Mode	The current IGMP Snooping router mode: all, default, multicastrouter, none, or ip.
Router Address List	A list of configured reserved IP multicast addresses that are treated as multicast router addresses.

Examples To show the current list of configured router multicast addresses, use the command:

```
sh igmpsn routera
```

Related Commands

add igmpsnooping routeraddress
delete igmpsnooping routeraddress
set igmpsnooping routermode
show igmpsnooping
show igmpsnooping counter

show ip igmp

Syntax `SHow IP IGMP [INTerface=`*`interface`*`] [DEStination=`*`ipadd`*`]`

where:

- *interface* is an interface name formed by concatenating a Layer 2 interface type, an interface instance, and optionally a hyphen followed by a logical interface number from 0 to 15. If a logical interface is not specified, 0 is assumed.
- *ipadd* is an IGMP multicast group address in dotted decimal notation.

Description This command displays general information about IGMP and the IGMP configuration on each IP interface (Figure 8 on page 91, Table 5 on page 92).

If an **interface** is specified, information is displayed only for that interface. Valid interfaces are:

- VLAN (such as vlan1, vlan1-1)

If a **destination** address is specified, information is displayed only for interfaces that have a multicast group membership matching the **destination** address. Any of the four octets of the IP address may be replaced by an asterix (*) to enable wildcard matches, for example 224.*.*.*.

Figure 8: Example output from the **show ip igmp** command

```
IGMP Protocol
--------------------------------------------------------------------------------
Status ........................... Enabled
Default Query Interval ........... 125 secs
Default Timeout Interval ......... 260 secs

Last Member Query Interval ....... 10 (1/10secs)
Last Member Query Count .......... 2
Robustness Variable .............. 2
Query Response Interval .......... 100 (1/10secs)
Disabled All-groups ports ........ 1,5,7

Interface Name ..................... vlan1              (DR)
Status ............................. Enabled
Other Querier timeout .............. 164 secs
IGMP Proxy ......................... Upstream
General Query Reception Timeout .... None
Group List ........................

  Group. 224.0.1.22         Last Adv. 10.194.254.254     Refresh time 184 secs
  Ports  24

  Group. 224.0.1.22         Static association           Refresh time Infinity
  Ports  11-14,17,19
  Static Ports 17,19

  All Groups                Last Adv. 10.116.2.1         Refresh time 254 secs
  Ports  24

--------------------------------------------------------------------------------
```

Table 5: Parameters in output of the **show ip igmp** command

Parameter	Meaning
General information about IGMP	
Status	Whether IGMP is enabled.
Default Query Interval	The default interval at which Host Membership Queries are sent.
Default Timeout Interval	The default interval after which entries are removed from the group database when no Host Membership Report is received.
Last Member Query Interval	Max Response Time inserted into Group-Specific Queries sent in response to Leave Group messages, and the amount of time between Group-Specific Query messages.
Last Member Query Count	The number of Group-Specific Queries sent before the switch assumes there are no local members.
Robustness Variable	IGMP is robust to (Robustness Variable-1) packet losses.
Query Response Interval	The Max Response Time (in 1/10 secs) inserted into the periodic General Queries.
Disabled All-groups ports	A list of ports that are disabled from acting as an all-groups port.
Information about each IP interface	
Interface Name	The name of an IP interface.
Status	Whether IGMP is enabled on the interface.
Other Querier timeout	The time that remains before a multicast router decides that there is no longer another multicast router that should be the querier.
IGMP Proxy	The status of IGMP Proxy on this interface; one of "Off", "Upstream", or "Downstream".
General Query Reception Timeout	The maximum expected time interval, in seconds, between successive IGMP general query messages arriving on the interface, or "none" if there is no limit. If a general query message is not received within the time interval, a log message and an SNMP trap are generated.
Group List	A list of multicast group memberships for this interface, or: • "No group memberships", if the interface has no multicast group members • "No matching group memberships", if the interface has no multicast group members matching the **destination** address
Group	The group multicast address.
Last Adv.	The last host to advertise the membership report, or "Static association" for static multicast groups.
Refresh time	The time in seconds until the membership group is deleted if another membership report is not received, or "Infinity" for static multicast associations.
Ports	The list of ports listening to this group.

Table 5: Parameters in output of the **show ip igmp** command (cont.)

Parameter	Meaning
Static Ports	The list of static ports listening to this group. This is a subset of the ports listed in the Ports field, and is only displayed for static groups on a VLAN.

Examples

To display general information about IGMP, use the command:

```
sh ip igmp
```

To limit the display to IP interfaces that have multicast group memberships matching 224.*.*.*, use the command:

```
sh ip igmp des=224.*.*.*
```

To display information about IGMP on interface “vlan1”, use the command:

```
sh ip igmp int=vlan1
```

Related Commands

add ip igmp destination
create ip igmp destination
delete ip igmp destination
destroy ip igmp destination
disable ip igmp
disable ip igmp interface
enable ip igmp
enable ip igmp interface
set ip igmp
show ip igmp counter

show ip igmp counter

Syntax

```
SHow IP IGMP COUnter [INTerface=interface]
   [DEStination=ipaddress]
```

where:

- *interface* is an interface name formed by concatenating a Layer 2 interface type, an interface instance, and optionally a hyphen followed by a logical interface number from 0 to 15. If a logical interface is not specified, 0 is assumed.
- *ipadd* is an IGMP multicast group address in dotted decimal notation.

Description

This command displays IGMP counters (see Figure 9 on page 94, Table 6 on page 94).

If an **interface** is specified, counters are displayed only for that interface. Valid interfaces are:

- VLAN (such as vlan1, vlan1-1)

If a **destination** address is specified, counters are displayed only for interfaces that have a multicast group membership matching the **destination** address. Any of the four octets of the IP address may be replaced by an asterix (*) to enable wildcard matches, for example 224.*.*.*.

Figure 9: Example output from the **show ip igmp counter** command

```
IGMP Counters
-------------------------------------------------------------------------------

Interface Name: vlan1

  inQuery ......................... 1       outQuery ....................... 5
  inV1Report ...................... 4
  inV2Report ...................... 7
  inLeave ......................... 0
  inTotal ........................ 12       outTotal ....................... 5

  badQuery ........................ 0
  badV1Report ..................... 0
  badV2Report ..................... 0
  badLeave ........................ 0
  badTotal ........................ 1

-------------------------------------------------------------------------------
```

Table 6: Parameters in output of the **show ip igmp counter** command

Parameter	Meaning
Interface Name	The name of an IP interface.
inQuery	The number of IGMP membership query messages that were received by the interface.
outQuery	The number of IGMP membership query messages that were transmitted by the switch for the interface.
inV1Report	The number of IGMP Version 1 membership report messages that were received by the interface.

Table 6: Parameters in output of the **show ip igmp counter** command (cont.)

Parameter	Meaning
inV2Report	The number of IGMP Version 2 membership report messages that were received by the interface.
inLeave	The number of IGMP Leave Group messages that were received by the interface.
inTotal	The total number of IGMP messages that were received by the interface.
outTotal	The total number of IGMP messages that were transmitted by the switch over the interface.
badQuery	The number of IGMP membership query messages with errors that were received by the interface.
badV1Report	The number of IGMP Version 1 membership report messages with errors that were received by the interface.
badV2Report	The number of IGMP Version 2 membership report messages with errors that were received by the interface.
badLeave	The number of IGMP Leave Group messages with errors that were received by the interface.
badLength	The number of IGMP packets received by the interface that were discarded due to an invalid packet length. This field is displayed only when IGMP debugging is enabled.
badChecksum	The number of IGMP packets received by the interface that were discarded due to an invalid packet checksum. This field is displayed only when IGMP debugging is enabled.
badType	The number of IGMP packets received by the interface that were discarded due to an unknown IGMP packet type. This field is displayed only when IGMP debugging is enabled.
badDest	The number of IGMP packets received by the interface that were discarded because they contained IGMP leave or report messages addressed to the all hosts group. This field is displayed only when IGMP debugging is enabled.
badNoReceiver	The number of IGMP packets received by the interface that were discarded because there was no handler for the packet type. This field is displayed only when IGMP debugging is enabled.
badTotal	The total number of IGMP messages with errors that were received by the interface.

Examples To display IGMP counters for all IP interfaces, use the command:

```
sh ip igmp cou
```

To limit the display to IP interfaces that have multicast group memberships matching 224.*.*.*, use the command:

```
sh ip igmp cou des=224.*.*.*
```

To display IGMP counters for interface “vlan1”, use the command:

```
sh ip igmp cou int=vlan1
```

Related Commands

add ip igmp destination
create ip igmp destination
delete ip igmp destination

destroy ip igmp destination
disable ip igmp
disable ip igmp interface
enable ip igmp
enable ip igmp interface
set ip igmp
show ip igmp

show ip igmp debug

Syntax `SHow IP IGMP DEBug`

Description This command shows the IGMP debugging options that have been set.

Figure 10: Example output from **show ip igmp debug** command

```
IGMP Debugging Information
------------------------------------------------------------
IGMP Debugging                  Enabled
Filter by group destination     224.1.2.3
Filter by source IP             10.10.1.123
------------------------------------------------------------
```

Table 7: Parameters in output of the **show ip igmp debug** command

Parameter	Meaning
IGMP Debugging	Whether IGMP debugging is enabled.
Filter by group destination	Group Destination Address specified by the **destination** parameter in the **enable ip igmp debug** command. When no parameter is given, "No" is displayed instead of the IP address.
Filter by source IP	Source IP address specified by the **sourceipaddress** parameter in the **enable ip igmp debug** command. When no parameter is given, "No" is displayed instead of the IP address.

Examples To display IGMP debugging information, use the command:

```
sh ip igmp deb
```

Related Commands **disable ip igmp debug**
enable ip igmp debug

show ip mvr

Syntax `SHow IP MVR [VLAN=1..4094]`

Description This command displays all information about MVR on the switch (Figure 11, Table 8).

The **vlan** parameter specifies the VLAN identifier of the multicast VLAN to be displayed. If none is provided, all multicast VLANs on the switch are displayed.

Figure 11: Example output from the **show ip mvr** command

```
Multicast VLAN
------------------------------------------------------------------------------
VLAN   Mode         Imtleave   Source Ports   Receiver Ports
                                                 Current Members  Group Address
------------------------------------------------------------------------------
22     compatible   3          9,10           1-3, 6-7
                                                 1,6              235.1.1.1
                                                 2,7              234.1.1.1
3      compatible   8          12,13          4,5,8,9
                                                 4,8              255.1.1.1
------------------------------------------------------------------------------
```

Table 8: Parameters in output of the **show ip mvr** command

Parameter	Meaning
VLAN	Multicast VLAN number.
Mode	Mode in which IGMP report packets are either sent out through source ports in the multicast VLAN, (“dynamic”) or not sent out (“compatible”).s
IMTLEAVE	Port number on which the Immediate Leave feature is enabled.
Source ports	Uplink ports that send or receive multicast data to and from the multicast VLAN.
Receiver ports	Ports that receive multicast data when they are the member of a multicast group.
Current Members	Receiver ports that are currently members of the multicast group.
Group Address	Multicast group IP addresses owned by this multicast VLAN.

Examples To show information for multicast VLAN number 22, use the command:

```
sh ip mvr vlan=22
```

Related Commands **show ip mvr counter**

show ip mvr counter

Syntax `SHow IP MVR [VLAN=1..4094] COUnter`

Description This command displays the number of times a port has joined and/or left a multicast VLAN (Figure 12, Table 9).

The **vlan** parameter specifies the VLAN identifier of the Multicast VLAN to be displayed. If none is provided, all multicast VLANs on the switch are displayed.

Figure 12: Example output from the **show ip mvr counter** command

```
Multicast VLAN
-------------------------------------------------------------
VLAN   Group Address     Joins          Leaves
-------------------------------------------------------------
23
       235.1.1.1         16             15
       215.1.1.1         9              8
3
       225.1.1.1         3              2
-------------------------------------------------------------
```

Table 9: Parameters in output of the **show ip mvr counter** command

Parameter	Meaning
VLAN	Multicast VLAN number.
Group Address	Multicast group IP address owned by this multicast VLAN.
Joins	Number of times the receiver port has become a member of the IP multicast stream.
Leaves	Number of times the receiver port has left the IP multicast stream.

Examples To display multicast VLAN counter information, use the command:

```
sh ip mvr vlan=22 cou
```

Related Commands **show ip mvr**

show pim

Syntax `SHow PIM`

Description This command displays detailed information about the PIM routing status on the switch, and is equivalent to specifying all of the following commands in the following order:

1. show PIM interface
2. show PIM route
3. show PIM neighbour
4. show PIM counters
5. show PIM debug
6. show PIM rpcandidate
7. show PIM bsrcandidate
8. show PIM rpset
9. show PIM timer
10. show PIM config

Examples To display detailed PIM routing status information, use the command:

```
sh pim
```

Related Commands

disable pim
enable pim
set pim
show pim bsrcandidate
show pim counters
show pim debug
show pim interface
show pim neighbour
show pim route
show pim rpcandidate
show pim rpset
show pim timer

show pim bsrcandidate

Syntax `SHow PIM BSRCandidate`

Description This command displays information about the switch as a BSR candidate for PIM-SM (Figure 13, Figure 14, Table 10).

Figure 13: Example output from the **show pim bsrcandidate** command for an elected BSR

```
PIM BSR Candidate
-----------------------------------------------------------
Preference ......................... 1
 BSR State ......................... Elected BSR
   Elected BSR IP address .......... 101.202.101.202
   Elected BSR preference .......... 1
```

Figure 14: Example output from the **show pim bsrcandidate** command for an unelected BSR candidate

```
PIM BSR Candidate
-----------------------------------------------------------
BSR State ......................... Accepts Preferred BSM
  Elected BSR IP address .......... 101.202.101.202
  Elected BSR preference .......... 1
```

Table 10: Parameters in output of the **show pim bsrcandidate** command

Parameter	Meaning
Preference	The preference value for the switch to be a candidate bootstrap router. The higher the number, the higher the priority. This parameter is present when the switch is the elected BSR.
BSR State	Current status of the BSR; one of "Accepts Preferred BSM" (the switch is available to become the BSR), or "Elected BSR" (the switch is the BSR).
Elected BSR IP address	IP address of the BSR. If the switch is the BSR, this address is one of the switch's addresses.
Elected BSR preference	The preference of the BSR. When the switch is the BSR, this is its preference.

Examples To display information about the switch as a BSR candidate, use the command:

```
sh pim bsrc
```

Related Commands

add pim bsrcandidate
delete pim bsrcandidate
disable pim
enable pim
set pim
set pim bsrcandidate
show pim

show pim config

Syntax `SHow PIM CONFig`

Description This command lists the command line interface commands that make up the PIM configuration (Figure 15).

Figure 15: Example output from the **show pim config** command

```
#PIM4 configuration
#
add pim interface=vlan1
add pim interface=vlan2 drpriority=100
enable pim
```

Examples To display the PIM configuration, use the command:

```
sh pim conf
```

Related Commands

disable pim
enable pim
set pim

show pim counters

Syntax `SHow PIM COUnters`

Description This command displays information about PIM counters (Figure 16, Figure 17, Table 11 on page 104).

Figure 16: Example output from the **show pim counters** command for PIM Sparse Mode

```
PIM4 Counters
-------------------------------------------------------------
Sparse Mode
-------------------------------------------------------------
:
  inHello .............. 14      outHello .............. 15
  inRegister ............ 0       outRegister ........... 0
  inRegisterStop ........ 0       outRegisterStop ....... 0
  inJP .................. 0       outJP ................. 0
  inAssert .............. 0       outAssert ............. 0
  inBSM ................. 8       outBSM ................ 3
  inCRPAdv .............. 0       outCRPAdv ............. 0
  inTotal ............... 22      outTotal ............... 18

 Bad:
  badHello .............. 0
  badRegister ........... 0
  badRegisterStop ....... 0
  badJP ................. 0
  badAssert ............. 0
  badBSM ................ 0
  badCRPAdv ............. 0
  badTotal .............. 0
```

Figure 17: Example output from the **show pim counters** command for PIM Dense Mode

```
PIM4 Counters
-------------------------------------------------------------
Dense Mode
-------------------------------------------------------------
:

  inHello .............. 25      outHello ............. 26
  inGraft ............... 0       outGraft ............. 0
  inGraftAck ............ 0       outGraftAck .......... 0
  inJP .................. 0       outJP ................ 0
  inAssert .............. 0       outAssert ............ 0
  inSRM ................. 0       outSRM ............... 0
  inTotal ............... 25      outTotal ............. 26

 Bad:
    badHello ............ 0
    badGraft ............ 0
    badGraftAck ......... 0
    badJP ............... 0
    badAssert ........... 0
    badTotal ............ 0
```

Table 11: Parameters in output of the **show pim counters** command

Parameter	Meaning
inHello	The number of PIM hello messages received by the interface.
inRegister	The number of PIM register messages that were received by the interface. This parameter is displayed for PIM-SM interfaces only.
inRegisterStop	The number of PIM register stop messages received by the interface. This parameter is displayed for PIM-SM interfaces only.
inGraft	The number of PIM graft messages received by the interface. This parameter is displayed for PIM-DM interfaces only.
inGrackAck	The number of PIM graft acknowledgement messages that were received by the interface. This parameter is displayed for PIM-DM interfaces only.
inJP	The number of PIM join and prune messages received by the interface.
inAssert	The number of PIM assert messages received by the interface.
inBSM	The number of PIM bootstrap messages received by the interface. This parameter is displayed for PIM-SM interfaces only.
inCRPAdv	The number of PIM candidate RP advertisement messages received by the interface. This parameter is displayed for PIM-SM interfaces only.
inSRM	The number of PIM state refresh messages received by the interface. This parameter is displayed for PIM-DM interfaces only.
inTotal	The total number of PIM messages received by the interface.
outHello	The number of PIM hello messages transmitted by the interface.
outRegister	The number of PIM register messages transmitted by the interface. This parameter is displayed for PIM-SM interfaces only.
outRegisterStop	The number of PIM register stop messages transmitted by the interface. This parameter is displayed for PIM-SM interfaces only.
outGraft	The number of PIM graft messages transmitted by the interface. This parameter is displayed for PIM-DM interfaces only.
outGrackAck	The number of PIM graft acknowledgement messages transmitted by the interface. This parameter is displayed for PIM-DM interfaces only.
outJP	The number of PIM join and prune messages transmitted by the interface.
outAssert	The number of PIM assert messages transmitted by the interface.

Table 11: Parameters in output of the **show pim counters** command (cont.)

Parameter	Meaning
outBSM	The number of PIM bootstrap messages transmitted by the interface. This parameter is displayed for PIM-SM interfaces only.
outCRPAdv	The number of PIM candidate RP advertisement messages transmitted by the interface. This parameter is displayed for PIM-SM interfaces only.
outSRM	The number of PIM state refresh messages transmitted by the interface. This parameter is displayed for PIM-DM interfaces only.
outTotal	The total number of PIM messages that were transmitted by the interface.
badHello	The number of PIM hello messages with errors that were received by the interface.
badRegister	The number of PIM register messages with errors received by the interface. This parameter is displayed for PIM-SM interfaces only.
badRegisterStop	The number of PIM register stop messages with errors received by the interface. This parameter is displayed for PIM-SM interfaces only.
badGraft	The number of PIM graft messages with errors received by the interface. This parameter is displayed for PIM-DM interfaces only.
badGrackAck	The number of PIM graft acknowledgement messages with errors received by the interface. This parameter is displayed for PIM-DM interfaces only.
badJP	The number of PIM join and prune messages with errors received by the switch.
badAssert	The number of PIM assert messages with errors received by the interface.
badBSM	The number of PIM bootstrap messages with errors received by the interface. This parameter is displayed for PIM-SM interfaces only.
badCRPAdv	The number of PIM candidate RP advertisement messages with errors received by the interface. This parameter is displayed for PIM-SM interfaces only.
badSRM	The number of PIM state refresh messages with errors received by the interface. This parameter is displayed for PIM-DM interfaces only.
badTotal	The total number of PIM messages with errors received by the interface.

Examples To display information about PIM counters, use the command:

```
sh pim cou
```

Related Commands

disable pim
enable pim
set pim
show pim
show pim bsrcandidate

show pim debug
show pim interface
show pim neighbour
show pim route
show pim rpcandidate
show pim rpset
show pim timer

show pim debug

Syntax `SHow PIM DEBug`

Description This command displays the list of PIM interface debugging options (Figure 18, Table 12).

Figure 18: Example output from the **show pim debug** command

```
PIM Debug Options
-------------------------------------------------------------
Debug Options Enabled: Join, Assert

Logging Options Enabled : status

Trapping Options Enabled: none

Info (1097049): The PIM module is not enabled.
```

Table 12: Parameters in output of the **show pim debug** command

Parameter	Meaning
Debug Options Enabled	A comma-separated list of the PIM debugging options that are enabled, or "None" if debugging is disabled, or "All" if all debugging is enabled. Options are listed with the **enable pim debug** command on page 70.
Logging Options Enabled	The logging options that are enabled. See **set pim log** command on page 79.
Trapping Options Enabled	The trapping options that are enabled. See **set pim log** command on page 79.

Examples To display a list of enabled PIM interface debugging options, use the command:

```
sh pim deb
```

Related Commands

disable pim
disable pim debug
enable pim
enable pim debug
set pim log
show pim
show pim bsrcandidate
show pim counters
show pim interface
show pim neighbour
show pim route
show pim rpcandidate
show pim rpset
show pim timer

show pim interface

Syntax `SHow PIM INTerface`

Description This command displays information about all PIM interfaces and their designated router status (Figure 19, Figure 20, Table 13). Valid interfaces are:

- VLAN (such as vlan1, vlan1-1)

Figure 19: Example output from the **show pim interface** command for PIM Sparse Mode.

```
PIM4 Sparse mode Interface Table
------------------------------------------------------------
Interface ........................
  IP address ..................... 172.128.71.25
    DR election by ............... DR priority
    DR priority .................. 10
    DR winner .................... Me
  Hello interval ................. 30

Interface ........................
  IP address ..................... 172.128.72.33
    DR election by ............... DR priority
    DR priority .................. 1
    DR winner .................... 172.128.72.14
  Hello interval ................. 30
```

Figure 20: Example output from the **show pim interface** command for PIM Dense Mode

```
PIM4 Dense mode Interface Table
------------------------------------------------------------
Interface ........................
  IP address ..................... 192.168.0.111
  State refresh capable .......... No
  Hello interval ................. 30
```

Table 13: Parameters in output of the **show pim interface** command

Parameter	Meaning
Interface	IP interfaces running PIM processes.
IP Address	The IP address on this interface.
DR election by	How this interface elects a DR; one of "DR priority "(the DR priority is transmitted in Hello messages and election is by priority), or "IP address" (the DR priority is not transmitted in Hello messages so election is by IP address).
DR priority	The priority for the DR candidate to become the PIM designated router. A candidate with a higher priority is more likely to become the DR.
DR Winner	The IP address of the PIM designated router for the interface, or "me" when this switch is the designated router.
State refresh capable	Whether this interface originates and processes State Refresh messages for PIM-DM.

Table 13: Parameters in output of the **show pim interface** command (cont.)

Parameter	Meaning
Hello interval	The interval, in seconds, at which the switch sends PIM Hello messages on this interface. The value 65535 indicates that the Hello message never expires.

Examples To display information about all PIM interfaces, use the command:

```
sh pim int
```

Related Commands

add pim interface
delete pim interface
disable pim
enable pim
reset pim interface
set pim interface
set pim
show pim
show pim bsrcandidate
show pim counters
show pim debug
show pim neighbour
show pim route
show pim rpcandidate
show pim rpset
show pim timer

show pim neighbour

Syntax `SHow pim NEIghbour`

Description This command displays information about the PIM Neighbour Table (Figure 21, Figure 22, Table 14).

Figure 21: Example output from the **show pim neighbour** command for PIM Sparse Mode

```
PIM4 Sparse mode Neighbour Table
------------------------------------------------------------
Interface ........................
  IP Address ..................... 137.39.3.93
    DR Priority .................. 1
    Neighbour Liveness Timer ..... 82
```

Figure 22: Example output from the **show pim neighbour** command for PIM Dense Mode

```
PIM4 Dense mode Neighbour Table
------------------------------------------------------------
Interface ........................
  IP Address ..................... 192.168.57.2
    Neighbour Liveness Timer ..... 105
    Is state refresh capable ..... No
```

Table 14: Parameters in output of the **show pim neighbour** command

Parameter	Meaning
Interface	Interface to which the PIM neighbour is connected.
IP Address	IP address of the neighbour.
DR Priority	Priority for this neighbour to become the designated router for the subnetwork.
Neighbour Liveness Timer	Time in seconds until the neighbour is removed from the neighbour table.
Is state refresh capable	Whether the neighbour originates and processes State Refresh messages for PIM-DM.

Examples To display information about the PIM Neighbour Table, use the command:

```
sh pim nei
```

Related Commands

disable pim
enable pim
set pim

show pim route

Syntax `SHow PIM ROUte`

Description This command displays information about the internal PIM routing table, for PIM Sparse Mode (Figure 23, Figure 24 on page 112, Table 15 on page 112) and/or Dense Mode (Figure 25 on page 115, Table 16 on page 115).

Figure 23: Example output from the **show pim route** command for PIM Sparse Mode, when the switch is the RP

```
PIM4 Sparse Mode Tree Information Base
--------------------------------------------------------------
Group ............................ 224.1.1.1
  Type ............................ (*,G)
    RP Address .................... I am the RP
    Expiry time ................... 630
    Join/prune time ............... 0
    Immediate output interfaces ..

  Type ............................ (S,G)
    Source ........................ 192.168.0.1
    RPF Neighbour to Src ......... 192.168.1.1
    RPF Interface to Src .........
    Expiry time ................... 180
    Keepalive time ................ 160
    Join/prune time ............... 0
    Register time ................. 0
    SPT bit ....................... Unset
    Inherited output interfaces ..
    Immediate output interfaces .. None

  Type ............................ (S,G,rpt)
    Source ........................ 192.168.0.1
    RP Address .................... I am the RP
    Expiry time ................... 180
    Override time ................. 0
    Inherited output interfaces ..

  Type ............................ (*,*,RP)
    RP Address .................... I am the RP
    Expiry time ................... 210
    Join/prune time ............... 0
    Immediate output interfaces .. None
```

Figure 24: Example output from the **show pim route** command for PIM Sparse Mode, when the switch is not the RP

```
PIM4 Sparse Mode Tree Information Base
--------------------------------------------------------------
Group ........................... 224.1.1.1
  Type ........................... (*,G)
    RP Address ................... 192.168.1.1
    RPF Neighbour to RP .......... 192.168.2.1
    RPF Interface to RP ..........
    Expiry time .................. 630
    Join/prune time .............. 0
    Immediate output interfaces ..

  Type ........................... (S,G)
    Source ....................... 192.168.0.1
    RPF Neighbour to Src ......... Directly connected
    RPF Interface to Src .........
    Expiry time .................. 230
    Keepalive time ............... 210
    Join/prune time .............. 0
    Register time ................ 21
    SPT bit ...................... Unset
    Inherited output interfaces ..
    Immediate output interfaces ..

  Type ........................... (S,G,rpt)
    Source ....................... 192.168.0.1
    RP Address ................... 192.168.1.1
    Expiry time .................. 230
    Override time ................ 0
    Inherited output interfaces ..

 Type ............................ (*,*,RP)
    RP Address ................... 192.168.1.1
    Next hop to RP ............... 192.168.2.1
    RPF Interface to RP ..........
    Expiry time .................. 210
    Join/prune time .............. 0
    Immediate output interfaces .. None
```

Table 15: Parameters in output of the **show pim route** command for PIM Sparse Mode

Parameter	Entry Type	Parameter for Entry Type	Meaning
Group			The IP address of the multicast group.
Type			The type of entry in the Tree Information Base.
	(*,G)		The entry for traffic from any source to a particular group.
		RP Address	The IP address of the rendezvous point for the group.
		RPF Neighbour to RP	The address of the PIM neighbour to the RP, taking into account any PIM assert messages. Packets from the RP would be received from this neighbour.
		RPF Interface to RP	The interface on which packets from the RP would be received.

Table 15: Parameters in output of the **show pim route** command for PIM Sparse Mode

Parameter	Entry Type	Parameter for Entry Type	Meaning
		Expiry time	The time remaining until this entry is deleted, in seconds. A zero value indicates that the timer is not running. This timer decrements when there are no (S,G) entries.
		Join/prune time	The join/prune timer in seconds. When the switch sees a prune message on the correct upstream interface, and it still needs to receive traffic via that rp tree, it sends a join message when this timer expires. A zero value indicates that the timer is not running.
		Immediate output interfaces	The interfaces with downstream routers or IGMP hosts that are interested in this (*,G) entry.
	(S,G)		The entry for traffic from a particular source to a particular group.
		Source	The IP address of the multicast sender.
		RPF Neighbour to Src	The address of the PIM neighbour to the source, taking into account any PIM assert messages. Packets from the source would be received from this neighbour. "Directly connected" indicates that the source is directly connected to the switch.
		RPF Interface to Src	The interface on which packets from the source would be received, if the source is in this multicasting domain.
		Expiry time	The time remaining until this entry is deleted, in seconds. A zero value indicates that the timer is not running. The expiry time is 20 seconds longer than the keepalive time.
		Keepalive time	The Keepalive timer in seconds. A zero value indicates that the timer is not running because no data is being received.
		Join/prune time	The join/prune timer in seconds. When the switch sees a prune message on the correct upstream interface, and it still needs to receive traffic via that sp tree, it sends a join message when this timer expires. A zero value indicates that the timer is not running.
		Register time	The register suppression time, in seconds. When this timer reaches the register probe time, a null register message is sent to the RP.
		SPT bit	Whether forwarding is set on the shortest path tree.
		Inherited output interfaces	The interfaces to forward (S,G) data to.
		Immediate output interfaces	The interfaces with downstream routers or IGMP hosts that are interested in this (S,G) data.

Table 15: Parameters in output of the **show pim route** command for PIM Sparse Mode

Parameter	Entry Type	Parameter for Entry Type	Meaning
	(S,G, rpt)		The entry that is used for suppressing traffic on the RP tree from a particular source to a particular group. This entry applies when the traffic is known to be flowing down the shortest path tree, so the traffic is no longer needed via the RP tree.
		Source	The IP address of the multicast sender.
		RP Address	The IP address of the rendezvous point for the group.
		Expiry time	The time remaining until this entry is deleted, in seconds.The expiry time is 20 seconds longer than the (S,G) Keepalive time.
		Override time	The override timer in seconds. When the switch sees a prune message on the correct upstream interface, and it still needs to receive traffic via that rp tree, it sends a join message when this timer expires. A zero value indicates that the timer is not running.
		Inherited output interfaces	The interfaces that still require (S,G) data via the RP tree.
	(*,*, RP)		The entry for handling multicast traffic to and from a network that is running a different multicast protocol. This entry applies when the switch is a PIM multicast border router (PMBR).
		RP Address	The IP address of the rendezvous point for the group.
		Next hop to RP	The address of the next routing device on the best unicast routing path to the RP.
		RPF Interface to RP	The interface on which packets from the RP would be received.
		Expiry time	The time remaining until this entry is deleted, in seconds.
		Join/Prune time	The join/prune timer in seconds. When the switch sees a prune message on the correct upstream interface, and it still needs to receive traffic via that rp tree, it sends a join message when this timer expires. A zero value indicates that the timer is not running.
		Immediate output interfaces	The interfaces with downstream routers that are interested in this (*,*,RP) entry.

Figure 25: Example output from the **show pim route** command for PIM Dense Mode

```
PIM4 Dense Mode Tree Information Base
-------------------------------------------------------------
  Source ........................ 172.95.1.1
  Group ......................... 238.1.2.3
    RPF Neighbour to Src ......... Directly connected
    RPF Interface to Src .........
    Source Alive time ............ 200
    Expiry time .................. 220
    Prune override time .......... 0
    Prune limit time ............. 0
    Immediate output interfaces ..

  Source ........................ 172.96.2.1
  Group ......................... 238.1.2.3
    RPF Neighbour to Src ......... 192.168.57.1
    RPF Interface to Src .........
    Keep Alive time .............. 200
    Expiry time .................. 220
    Prune override time .......... 0
    Prune limit time ............. 50
    Immediate output interfaces ..
```

Table 16: Parameters in output of the **show pim route** command for PIM Dense Mode

Parameter	Meaning
Source	The IP address of the multicast sender.
Group	The IP address of the multicast group.
RPF Neighbour to Src	The address of the PIM neighbour to the source, taking into account any PIM assert messages. Packets from the source would be received from this neighbour. "Directly connected" indicates that the source is directly connected to the switch.
RPF Interface to Src	The interface on which the switch expects to receive traffic from the source.
Keep Alive time	The Keepalive timer in seconds. A zero value indicates that the timer is not running because no data is being received.
Source Alive time	An alive timer in seconds that is the equivalent of the Keepalive timer but applies to directly connected sources. A zero value indicates that the timer is not running because no data is being received.
Expiry time	The time remaining until this entry is deleted, in seconds. The expiry time is 20 seconds longer than the (S,G) Keepalive or Sourcealive time.
Prune override time	The prune override timer, in seconds. When the switch sees a prune message on the correct upstream interface, and it still needs to receive traffic, it sends a join message when this timer expires. A zero value indicates that the timer is not running.
Prune limit time	The prune limit, in seconds. A zero value indicates that the timer is not running. The switch cannot send a data-triggered prune until this timer expires.
Immediate output interfaces	The interfaces with routers or IGMP hosts that are interested in this (S,G) data.

Examples To display information about the internal PIM routing table, use the command:

```
sh pim rou
```

Related Commands

disable pim
enable pim
set pim
show pim
show pim bsrcandidate
show pim counters
show pim debug
show pim interface
show pim neighbour
show pim rpcandidate
show pim rpset
show pim timer

show pim rpcandidate

Syntax `SHow PIM RPCandidate`

Description This command displays information about multicast groups for which the switch is a PIM-SM rendezvous point candidate (Figure 26, Table 17).

Figure 26: Example output from the **show pim rpcandidate** command

```
PIM4 RP Candidate
-------------------------------------------------------------
Priority ..................... 192
Interface .....................vlan1
   Group address/Mask ........... 224.1.1.1 / 255.255.255.255
    Group address/Mask .......... 224.2.2.0 / 255.255.255.0
```

Table 17: Parameters in output of the **show pim rpcandidate** command

Parameter	Meaning
Priority	Priority for the switch to become the rendezvous point for any multicast groups.
Group Address	Multicast groups associated with the specified rendezvous point.
Mask	Mask for the address.
Interface	Interface the switch advertises itself as when advertising as a rendezvous point for multicast groups.

Examples To display information about multicast groups for which the switch is a rendezvous point candidate, use the command:

```
sh pim rpc
```

Related Commands

add pim rpcandidate
delete pim rpcandidate
disable pim
enable pim
set pim
set pim rpcandidate
show pim

show pim rpset

Syntax `SHow PIM RPSet`

Description This command displays the static group-to-RP mapping (Figure 27, Table 18), followed by the elected bootstrap router's current set of RP candidates and the groups they are configured for (Figure 28, Table 19). It applies to PIM-SM only.

Figure 27: Example output from the **show pim rpset** command when the RP is statically configured

```
PIM4 Static RP Mapping
------------------------------------------------------------
RP Address ......................... 192.168.2.1
    Group address/Mask ................ 239.1.0.0 /
255.255.0.0
```

Table 18: Parameters in output of the **show pim rpset** command when the RP is statically configured

Parameter	Meaning
RP address	IP address of the router that is statically configured as the RP for the following group(s).
Group address	IP address of the multicast group.
Mask	Mask for the multicast group address.

Figure 28: Example output from the **show pim rpset** command when the RP is determined using the bootstrap mechanism

```
PIM4 RP Set Information
------------------------------------------------------------

Group address/Mask ........ 224.1.1.1 / 255.255.255.255
    RP Candidate address .. 192.168.1.1
      Priority ............ 192
      Holdtime ............ 120
    RP Candidate address .. 192.168.2.1
      Priority ............ 180
      Holdtime ............ 120
```

Table 19: Parameters in output of the **show pim rpset** command when the RP is determined using the bootstrap mechanism

Parameter	Meaning
Group address	IP address of the multicast group.
Mask	Mask for the multicast group address.
RP Candidate address	IP addresses of each RP candidate for the multicast group and mask pair.
Priority	Priority for the RP candidate to become the RP. A candidate with a lower priority is more likely to become the RP.

Table 19: Parameters in output of the **show pim rpset** command when the RP is determined using the bootstrap mechanism

Parameter	Meaning
Holdtime	The time in seconds for which this RP candidate is valid. Unless the RP advertisement is refreshed, the RP candidate is deleted when this time has elapsed.

Examples

To display information about multicast group and mask pairs, use the command:

```
sh pim rps
```

Related Commands

disable pim
enable pim
set pim
show pim

show pim staterefresh

Syntax `SHow PIM STATerefresh`

Description This command displays the internal State Refresh table for PIM-DM (Figure 29, Table 20).

Figure 29: Example output from the **show pim staterefresh** command

```
PIM4 Dense Mode State Refresh
-------------------------------------------------------------
  Source ............................. 172.95.2.1
  Group .............................. 238.1.2.3
    Originator state ................. Orginator
      Direct Connect to source on .....
      Source alive timer ............. 200
      State refresh timer ............ 50


  Source ............................. 172.96.2.1
  Group .............................. 238.1.2.3
    Originator state ................. Not Originator
```

Table 20: Parameters in output of the **show pim staterefresh** command

Parameter	Meaning
Source	IP address of the multicast sender.
Group	IP address of the multicast group.
Originator state	Whether the switch can act as a state refresh message originator. A switch acts as an originator when the source is directly connected.
Direct Connect to source on	Interface to which the source is connected.
Source alive timer	An alive timer in seconds for directly connected sources. A zero value indicates that the timer is not running because no data is being received.
State refresh timer	Time in seconds before the next state refresh message is sent.

Examples To display the internal State Refresh table, use the command:

```
sh pim stat
```

Related Commands

disable pim
enable pim
set pim
show pim

show pim timer

Syntax `SHow PIM TIMer`

Description This command displays information about timer intervals for PIM operations (Figure 30, Table 21).

Figure 30: Example output from the **show pim timer** command

```
PIM Timers
-------------------------------------------------------------
Join/Prune interval ................... 60
Register probe time ................... 5
Register suppression time ............. 60
Keep Alive time ....................... 210
BSM interval .......................... 60
RP adv interval ....................... 60
Prune hold time ....................... 210
Source Alive time ..................... 210
State refresh interval ................ 60
```

Table 21: Parameters in output of the **show pim timer** command

Parameter	Meaning
Join/Prune Interval	Time interval in seconds at which the switch sends join/prune messages.
Register Probe time	Time interval in seconds that the DR waits for another register stop message after sending a null register message to the RP.
Register Suppression time	Time interval in seconds at which the sender's DR sends null register messages to the group's RP.
Keep Alive time	Length in seconds that the join state for a particular source and group pair is maintained in the absence of data for that pair.
BSM interval	Length in seconds that the switch sends bootstrap messages when it is the bootstrap router in the domain.
RP adv interval	Length in seconds that the switch sends C-RP-advertisements.
Prune hold time	Length in seconds that upstream routers maintain the prune state.
Source Alive time	Length in seconds that a switch acting as a state refresh originator is active in the absence of data packets from the source.
State refresh interval	Length in seconds that a switch sends state refresh messages.

Examples To display information about timer intervals for PIM operations, use the command:

```
sh pim tim
```

Related Commands

disable pim
enable pim
set pim
show pim

Link Layer Discovery Protocol (LLDP)

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disable lldp systemname 17
enable lldp managementaddress 18
enable lldp notifications 19
enable lldp port 20
enable lldp portdescription 21
enable lldp systemcapabilities 22
enable lldp systemdescription 23
enable lldp systemname 24
purge lldp 24
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Introduction

This chapter describes the Link Layer Discovery Protocol (LLDP), how it is implemented on the switch, and how to configure the switch to use it.

LLDP is a neighbour discovery protocol. Neighbour discovery protocols define standard methods for Ethernet network devices, such as switches and routers, to receive and/or transmit device-related information to other nodes on the network, and to store the information that is learned about other devices.

Link Layer Discovery Protocol

Overview

Link Layer Discovery Protocol (LLDP) is a Layer 2 protocol defined by the IEEE *S*tandard 802.1AB-2005. For a complete set of rules and information about LLDP, refer to this standard.

LLDP allows Ethernet network devices to advertise details about themselves, such as device configuration, capabilities and identification, to directly connected devices on the network that are also using LLDP.

LLDP is a "one hop" protocol; LLDP information can only be sent to and received by devices that are directly connected to each other by the same link. Devices that are directly connected to each other are called **neighbours**. Advertised information is not forwarded on to other devices on the network.

SNMP

LLDP is designed to be managed with Simple Network Management Protocol (SNMP). We provide a command line interface to manage LLDP, however SNMP is the recommended interface as LLDP is designed to be automatically managed from Network Management Systems (NMS).

What LLDP does

Advertisements are sent in packets called *LLDP Data Units* (LLDPDUs). The data sent and received via LLDPDUs is useful for many reasons. For example, the switch can discover which of the other devices on the network are each other's neighbours, and through which ports they connect to each other.

You can configure the switch to do the following:

- transmit information about itself to neighbours
- receive device information from neighbours
- store and manage received information in an LLDP MIB

Each device that uses LLDP has its own LLDP agent, which is a software entity that implements LLDP. The LLDP agent is responsible for the reception, transmission, and management of LLDP.

LLDP defines the following:

- A set of common advertisement messages (Type Length Values). For more information, see **Type Length Values**.
- A protocol for transmitting and receiving advertisements. For more information, see **Transmission and Reception**.
- A method for storing the information that is contained within received advertisements. For more information, see **Storing LLDP Information**.

Type Length Values

The LLDP agent transmits and receives information via LLDPDUs. A single LLDPDU contains multiple advertisement messages, each of which is communicated within a Type Length Value (TLV). TLVs are short information elements which communicate complex data, such as variable length strings, in an organized format. Each TLV advertises a single type of information that identifies the sending device, for example, its device ID, type, or the address or addresses.

The following table describes the fields in a TLV.

Field	Description
Type	Identifies the kind of information. It consists of a a 16-bit Type code.
Length	Identifies the length of the information. It consists of a 16-bit value that specifies the number of bytes of data in the Value field.
Value	Contains the actual value of the advertised information. This is a variable length data field.

Each LLDPDU contains at least four mandatory TLVs by default. You can also configure the switch to send up to five optional additional TLVs.

Mandatory TLVs

Mandatory TLVs are sent by default in every LLDPDU. These advertise the device's MAC Service Access Point (MSAP) identifier, as well as the time period for which the device's information is valid. All LLDP information associated with a device is identified with the device's MSAP identifier.

The MSAP identifier is defined by the IEEE Standard 802.1AB-2005 as follows: “the concatenation of the chassis ID and the port ID is used by LLDP as an MSAP identifier, to identify the LLDP agent and physical port associated with an IEEE 802® LAN station” For more information, see the IEEE Standard 802.1AB-2005.

The following table describes mandatory TLVs.

Mandatory TLV	Description
Chassis ID	Identifies the device's chassis. It is the MAC address of the switch, or the MAC address of the port for Eth ports.
PortID	Identifies the port that transmitted the LLDPDU.
Time To Live (TTL)	Indicates the length of time in seconds for which the information received in the LLDPDU remains valid. If the value is greater than zero, the information is stored in the LLDP remote system MIB. If the value is zero, the information is no longer valid, and is removed from the MIB.
End of LLDPDU	Signals that there are no more TLVs in the LLDPDU.

Optional TLVs

You can configure the switch to send up to five optional TLVs alongside the mandatory TLVs in each LLDPDU. The the following table describes the optional TLVS from the LLDP-defined Basic Management TLV Set.

Optional TLV	Description
Port description	A description of the device's port in alpha-numeric format.
System name	The system's assigned name in alpha-numeric format.
System description	A description of the device in alpha-numeric format. This includes the system name, hardware versions, operating system, and the networking software supported in the device.
System capabilities	The device's router and bridge functions, and whether or not these functions are currently enabled.
Management address	The address of the local LLDP agent. This can be used to obtain information related to the local device. The **set lldp managementaddress** command lets you specify an IPv4 address to advertise in this TLV. Otherwise the switch's MAC address is used.

LLDPDU and TLV error handling

LLDPDUs and TLVs that contain detectable errors are discarded.

If a TLV is not recognized, but contains no basic format errors, the LLDP agent assumes that it is validated and stores it for possible later retrieval by network management.

Transmission and Reception

LLDP is a one-way protocol. That is, the information transmitted in LLDPDUs flows in one direction only, from one device to its neighbours, and the communication ends there. Transmitted LLDPDUs do not solicit responses, and received LLDPDUs do not solicit acknowledgement. LLDP agents cannot solicit any information from other devices.

By default, when you enable LLDP on a port, both the transmission and reception of LLDPDUs is enabled. However, you can separately enable and disable transmission and reception. The LLDP agent can operate in any one of the following user-defined modes:

- **Transmit-only mode**
  The agent can only transmit current information about the local system.
- **Receive-only mode**
  The agent can only receive current information about remote systems.
- **Transmit and receive mode**
  The agent can both transmit local information and receive remote information.

See "Configuring LLDP" on page 8 for information on how to configure these modes.

Transmission

When LLDP transmission is **enabled**, the LLDP agent advertises information about your switch to neighbours at regular, user-configured intervals.

Each transmitted LLDPDU contains the mandatory TLVs, and any optional TLVs that you have enabled. See "Type Length Values" on page 3 for more information about TLVs. Or, see "Configuring LLDP" on page 8 to find out how to configure the TLVs that are advertised on your switch.

When LLDP transmission is **disabled**, one of two scenarios occurs. If transmission is disabled:

- because you have disabled a port using an LLDP command, then the LLDP agent transmits a single 'shutdown' LLDPDU with a Time-To-Live (TTL) TLV that has a value of "0". This tells any remote neighbouring devices to remove the information associated with your switch from their remote systems MIB.
- for any other reason, for example you have disabled the port using **disable switch port**, then the LLDP agent does not send a shutdown LLDPDU.

Note that LLDP does not transmit LLDPDUs on switch ports that are untagged members of any VLAN other than the default VLAN (vlan1)

Transmission delay timer

Transmission cycles can be initiated by either of the following:

- the expiration of a transmit countdown timing counter
- a change to the status or value of one or more of the TLVs associated with your local system

A series of successive changes over a short period of time can trigger the agent to send a large number of LLDPDUs. To prevent this, there is a transmission delay timer. This establishes a minimum length of time that must elapse between successive LLDP transmissions. The default is two seconds, but you can configure this to suit your network. For more information, see the **set lldp txdelay** command on page 27.

Reception

When LLDP reception is **enabled** on a port, the LLDP agent receives advertised information from and about remote neighbouring devices, and stores this data in the remote systems MIB. For more information, see "LLDP Remote Systems MIB" on page 6.

When LLDP reception is **disabled** on a port, the LLDP agent does not receive any neighbour advertisements.

Storing LLDP Information

Whenever an LLDP device receives a valid and current LLDP advertisement from a neighbouring network device, it stores the information in an IEEE-defined Simple Network Management Protocol (SNMP) Management Information Base (MIB). For more information, see Section 12.2 of the IEEE Standard 802.1AB-2005.

LLDP Local System MIB

Information about your device is called local system information. The LLDP local system MIB maintains this information, which consists of device details, as well as any user-configured information that you have set up for your switch, for example a port description or a management address.

LLDP Remote Systems MIB

Information gained from neighbouring devices is called *remote system information*. The LLDP remote systems MIB maintains this information.

The length of time for which neighbour information remains in the LLDP remote systems MIB is determined by the Time-To-Live (TTL) value of received LLDPDUs:

- When an LLDPDU first arrives from a neighbour, the LLDP agent initializes a timer.
- As new LLDPDUs arrive from that neighbour, this refreshes the timer.
- When the timer reaches the TTL value, the LLDP agent deletes the neighbour's information from the MIB.

This ensures that only valid LLDP information is stored.

Any remote, organization-specific TLV values are maintained in LLDP's organizationally-defined remote device LLDP MIB extensions. For more information, see Section 12 of the IEEE Standard 802.1AB-2005.

Remote tables change event

Whenever a new neighbour is discovered, or an existing neighbour advertises a change, for example a new TLV or a change in the TTL, a remote tables change event is activated. At this time:

- A trigger and log are activated. For information about LLDP triggers, see LLDP Triggers on page 10. For information about log messages, see Appendix A, Messages.
- If you have notifications enabled, the notification **lldpRemTablesChange** is sent. For more information, see "LLDP MIB Notifications" in the IEEE Standard 802.1AB-2005.

Size limitations

To prevent the remote systems MIB from using large amounts of memory and possibly affecting the operation of your switch, the following limitations are enforced:

- The total size of the MIB can be a maximum of 5MB, or 5% of your available memory - whichever is the lesser amount.
- There can be a maximum of five neighbours per port.

Once either of these limits is reached, the LLDP agent stops processing new neighbours. This condition is called **toomanyneighbours**. For more information, see Section 10.3.4 of the IEEE Standard 802.1AB-2005.

When the **toomanyneighbours** condition occurs, a trigger is sent, and a log is activated. For more information, see LLDP Triggers on page 10, and Appendix A, Messages.

Clearing data

You can clear all the data stored in the LLDP remote systems MIB using the **purge lldp** command on page 24. This clears all current remote LLDP MIB data. LLDP reverts to its default configuration, which means that LLDP is disabled for all ports.

See also

For information about configuring the LLDP MIB, see "Configuring LLDP" on page 8.

For other information about the LLDP MIB, see Appendix C, SNMP MIBs.

Configuring LLDP

LLDP is best configured and managed with SNMP, however you can also use the command line interface (CLI). This section contains an example of a basic LLDP configuration using the CLI.

Enabling and disabling LLDP

By default, LLDP is disabled. To enable LLDP on a port, list of ports, or all ports, use the command:

```
enable lldp port={all|port-list} [{tx|rx|txrx}]
```

To disable LLDP on a port, list of ports, or all ports, use the command:

```
disable lldp port={all|port-list} [{tx|rx|txrx}]
```

By default, when you enable a port for LLDP, both LLDP transmission and reception are enabled. To enable either LLDP transmission or reception only on the chosen ports, specify either **tx** or **rx**.

Enabling and disabling LLDP TLVs

When LLDP is enabled on a port, the LLDP agent advertises all TLVs by default. However, you can separately enable or disable each optional TLV on the port, using the following commands:

TLV	Enable using...	Disable using...
Port Description	`enable lldp portdescription`	`disable lldp portdescription`
System Name	`enable lldp systemname`	`disable lldp systemname`
System Description	`enable lldp systemdescription`	`disable lldp systemdescription`
System Capabilities	`enable lldp systemcapabilities`	`disable lldp systemcapabilities`
Management Address	`enable lldp managementaddress`	`disable lldp managementaddress`

For more information about TLVs, see "Type Length Values" on page 3.

LLDP notifications

To enable LLDP notifications, use the command:

```
enable lldp notifications [other-options]
```

To disable LLDP notifications, use the command:

```
disable lldp notifications [other-options]
```

To set the amount of time between LLDP notifications, use the command:

```
set lldp notification interval [other-options]
```

Purging and re-setting LLDP

To clear your existing LLDP configuration information and all remote LLDP MIB data, use the command:

```
purge lldp [other-options]
```

To clear all remote LLDP MIB data, and start the LLDP re-initialization procedure, use the command:

```
reset lldp [other-options]
```

Monitoring LLDP

To display general LLDP information, use the command:

```
show lldp [other-options]
```

To display information about LLDP counters, use the command:

```
show lldp counters [other-options]
```

To display information about LLDP memory, use the command:

```
show lldp memory [other-options]
```

To display detailed information about LLDP neighbours, use the command:

```
show lldp neighbour [other-options]
```

LLDP Triggers

You can use the Trigger Facility to automatically run specific command scripts when particular triggers are activated. When a trigger is activated by an event, parameters specific to the event are passed to the script that is run. Triggers can be activated:

- when the LLDP remote systems MIB changes
- when LLDP too many neighbour events occur

For more information about the Trigger Facility, see Chapter 5, Trigger Facility.

Module LLDP

Event LLDPRemotetablechange
Description The LLDP remote systems MIB changes.
Parameters You cannot specify any command parameters in the **create trigger** command.
Script arguments The trigger passes arguments in the following table to the script:

Argument	Description
%1	Value of LLDP MIB object lldpStatsRemTablesInserts
%2	Value of LLDP MIB object lldpStatsRemTablesDeletes
%3	Value of LLDP MIB object lldpStatsRemTablesDrops
%4	Value of LLDP MIB object lldpStatsRemTablesAgeouts

Example To create trigger 1, which activates whenever the LLDP remote systems MIB changes, use the command:

```
create trigger=<number> module=lldp
   event=lldpremotetablechange
```

Module LLDP

Event LLDPToomanyneighbours
Description There are too many active LLDP neighbours in the network.
Parameters You cannot specify any command parameters in the **create trigger** command.
Script arguments The trigger passes arguments in the following table to the script:

Argument	Description
%1	The system name of the neighbour that was refused
%2	The port description of the port on which the LLDPDU was received

Example To create trigger 1, which activates whenever there are too many active LLDP neighbours in the network, use the command:

```
create trigger=<number> module=lldp
   event=lldptoomanyneighbours
```

Command Reference

This section describes the commands available on the switch to enable, configure, control and monitor LLDP.

The shortest valid command is denoted by capital letters in the Syntax section. See "Conventions" on page lxxxii of About this Software Reference in the front of this manual for details of the conventions used to describe command syntax. See Appendix A, Messages for a complete list of messages and their meanings.

disable lldp managementaddress

Syntax `DISable LLDP MANAgementaddress [POrt={ALL|`*`port-list`*`}]`

Description This command stops the switch from advertising the management address TLV on the specified ports. The LLDP agent now sends LLDPDUs without management address information.

Unless an IPv4 management address has been set using the **set lldp managementaddress** command, the **managementaddress** is the MAC address of the switch.

Use the **port** parameter to define the ports for which to disable management address TLV advertisement, either a list of ports or all ports. *port-list* can be any/all of the following:

- a single switch port number. Port numbers start at 1 and end at *m*, where *m* is the highest numbered port.
- a range of switch port numbers (specified as *n-m*).
- a comma-separated list of switch port numbers and/or ranges.
- a single Ethernet interface (specified as eth*n*).
- a comma-separated list of Ethernet interfaces. Ethernet port numbers start at eth0 and end at eth*n*, where *n* is the highest numbered Ethernet port.
- the Ethernet interface eth0.

By default, LLDP management address advertisement is enabled for all ports.

Examples To stop the switch from advertising the management address on ports 1 and 2, use the command:

```
dis lldp mana po=1,2
```

To stop the switch from advertising the management address on all ports, use one of the commands:

```
dis lldp mana
```

```
dis lldp mana po=all
```

See Also **disable lldp port**
enable lldp managementaddress
set lldp managementaddress
show lldp

disable lldp notifications

Syntax `DISable LLDP NOTIfications [POrt={ALL|`*`port-list`*`}]`

Description This command stops the switch from sending LLDP SNMP notifications from the specified ports. Notifications are SNMP traps, triggers, and logs.

Use the **port** parameter to specify the ports for which to disable LLDP notifications, either a list of ports or all ports. *port-list* can be any/all of the following:

- a single switch port number. Port numbers start at 1 and end at *m*, where *m* is the highest numbered port.
- a range of switch port numbers (specified as *n-m*).
- a comma-separated list of switch port numbers and/or ranges.
- a single Ethernet interface (specified as eth*n*).
- a comma-separated list of Ethernet interfaces. Ethernet port numbers start at eth0 and end at eth*n*, where *n* is the highest numbered Ethernet port.
- the Ethernet interface eth0.

By default, LLDP notifications are disabled for all ports.

To set the amount of time between notifications, use **set lldp notification interval** command on page 26.

Examples To stop the switch from sending LLDP notifications from ports 1 and 2, use the command:

```
dis lldp noti po=1,2
```

To stop the switch from sending LLDP notifications from all ports, use one of the commands:

```
dis lldp noti
```

```
dis lldp noti po=all
```

See Also
disable lldp port
enable lldp notifications
set lldp notification interval
show lldp

disable lldp port

Syntax `DISable LLDP POrt={ALL|`*`port-list`*`} [{TX|RX|TXRX}]`

Description This command disables the specified LLDP actions on the specified ports, either **tx** (transmission), **rx** (reception), or **txrx** (both). By default, all LLDP actions are disabled for all ports.

Parameter	Description	
POrt	The ports for which to disable the specified LLDP actions, either a list of ports or all ports. *port-list* can be any/all of the following: • a single switch port number. Port numbers start at 1 and end at *m*, where *m* is the highest numbered port. • a range of switch port numbers (specified as *n-m*). • a comma-separated list of switch port numbers and/or ranges. • a single Ethernet interface (specified as ethn). • a comma-separated list of Ethernet interfaces. Ethernet port numbers start at eth0 and end at eth*n*, where *n* is the highest numbered Ethernet port. • the Ethernet interface eth0. Default: **all**	
TX|RX|TXRX	Specify:	To:
	TX	Stop the LLDP agent from **transmitting** LLDPDUs on the specified ports.
	RX	Stop the LLDP agent from **receiving** LLDPDUs on the specified ports.
	TXRX	Stop the LLDP agent from both **transmitting and receiving** LLDPDUs on the specified ports.
	Default: **txrx**	

Examples To stop the switch from transmitting LLDPDUs from all ports, use the command:

```
dis lldp po tx
```

To stop the switch from both transmitting and receiving LLDPDUs on ports 1 to 3, use one of the commands:

```
dis lldp po=1-3
```

```
dis lldp po=1-3 txrx
```

See Also **enable lldp port**
purge lldp
reset lldp
show lldp

disable lldp portdescription

Syntax `DISable LLDP PORTDescription [POrt={ALL|`*`port-list`*`}]`

Description This command stops the switch from advertising the port description TLV on the specified ports. This is the IEEE 802 LAN station's port description that is associated with the local system. The LLDP agent now sends LLDPDUs without port description information.

Use the **port** parameter to specify the ports for which to disable port description TLV advertisement, either a list of ports or all ports. *port-list* can be any/all of the following:

- a single switch port number. Port numbers start at 1 and end at *m*, where *m* is the highest numbered port.
- a range of switch port numbers (specified as *n-m*).
- a comma-separated list of switch port numbers and/or ranges.
- a single Ethernet interface (specified as ethn).
- a comma-separated list of Ethernet interfaces. Ethernet port numbers start at eth0 and end at eth*n*, where *n* is the highest numbered Ethernet port.
- the Ethernet interface eth0.

By default, LLDP port description advertisement is enabled for all ports.

Examples To stop the switch from advertising the port description on port 1 and 2, use the command:

```
dis lldp portd po=1,2
```

To stop the switch from advertising the port description on all ports, use one of the commands:

```
dis lldp portd
```

```
dis lldp portd po=all
```

See Also **disable lldp port**
enable lldp portdescription
set switch port
show lldp

disable lldp systemcapabilities

Syntax `DISable LLDP SYSTEMCapabilities [POrt={ALL|`*port-list*`}]`

Description This command stops the switch from advertising the system capabilities TLV on the specified ports. System capabilities are the primary functions of your system, including bridge and/or switch.

The LLDP agent now sends LLDPDUs without system capabilities information.

Use the **port** parameter to specify the ports for which to disable system capability TLV advertisement, either a list of ports or all ports. *port-list* can be any/all of the following:

- a single switch port number. Port numbers start at 1 and end at *m*, where *m* is the highest numbered port.
- a range of switch port numbers (specified as *n-m*).
- a comma-separated list of switch port numbers and/or ranges.
- a single Ethernet interface (specified as ethn).
- a comma-separated list of Ethernet interfaces. Ethernet port numbers start at eth0 and end at eth*n*, where *n* is the highest numbered Ethernet port.
- the Ethernet interface eth0.

By default, LLDP system capabilities advertisement is enabled for all ports.

Examples To stop the switch from advertising the system capabilities on ports 1 and 2, use the command:

```
dis lldp systemc po=1,2
```

To stop the switch from advertising the system capabilities on all ports, use one of the commands:

```
dis lldp systemc
```

```
dis lldp systemc po=all
```

See Also **disable lldp port**
enable lldp systemcapabilities
show lldp

disable lldp systemdescription

Syntax `DISable LLDP SYSTEMDescription [POrt={ALL|`*`port-list`*`}]`

Description This command stops the switch from advertising the system description TLV on the specified ports. This is the description of the local system, and is displayed in output of the **show system** command.

The LLDP agent now sends LLDPDUs without system description information.

Use the **port** parameter to specify the ports for which to disable system description TLV advertisement, either a list of ports or all ports. *port-list* can be any/all of the following:

- a single switch port number. Port numbers start at 1 and end at *m*, where *m* is the highest numbered port.
- a range of switch port numbers (specified as *n-m*).
- a comma-separated list of switch port numbers and/or ranges.
- a single Ethernet interface (specified as ethn).
- a comma-separated list of Ethernet interfaces. Ethernet port numbers start at eth0 and end at eth*n*, where *n* is the highest numbered Ethernet port.
- the Ethernet interface eth0.

By default, LLDP system description advertisement is enabled for all ports.

Examples To stop the switch from advertising the system description on port 1 and 2, use the command:

```
dis lldp systemd po=1,2
```

To stop the switch from advertising the system description on all ports, use one of the commands:

```
dis lldp systemd
```

```
dis lldp systemd po=all
```

See Also **disable lldp port**
enable lldp systemdescription
show lldp

disable lldp systemname

Syntax `DISable LLDP SYSTEMName [POrt={ALL|`*`port-list`*`}]`

Description This command stops the switch from advertising the system name TLV on the specified ports. The LLDP agent now excludes the local system name information from any LLDPDUs it sends.

Use the **port** parameter to specify the ports for which to disable system name TLV advertisement, either a list of ports or all ports. *port-list* can be any/all of the following:

- a single switch port number. Port numbers start at 1 and end at *m*, where *m* is the highest numbered port.
- a range of switch port numbers (specified as *n-m*).
- a comma-separated list of switch port numbers and/or ranges.
- a single Ethernet interface (specified as ethn).
- a comma-separated list of Ethernet interfaces. Ethernet port numbers start at eth0 and end at eth*n*, where *n* is the highest numbered Ethernet port.
- the Ethernet interface eth0.

By default, LLDP system name advertisement is enabled for all ports.

Examples To stop the switch from advertising the system name on port 1 and 2, use the command:

```
dis lldp systemn po=1,2
```

To stop the switch from advertising the system name on all ports, use one of the commands:

```
dis lldp systemn
```

```
dis lldp systemn po=all
```

See Also **disable lldp port**
enable lldp systemname
show lldp

enable lldp managementaddress

Syntax `ENAble LLDP MANAgementaddress [POrt={ALL|`*`port-list`*`}]`

Description This command enables management address TLV advertisement on the specified ports. The LLDP agent now includes management address information in any LLDPDUs it sends.

By default, the **managementaddress** is the MAC address of the switch. To advertise the IPv4 management address of the local LLDP agent instead, use the **set lldp managementaddress** command.

Use the **port** parameter to define the ports for which to enable management address TLV advertisement, either a list of ports or all ports. *port-list* can be any/all of the following:

- a single switch port number. Port numbers start at 1 and end at *m*, where *m* is the highest numbered port.
- a range of switch port numbers (specified as *n-m*).
- a comma-separated list of switch port numbers and/or ranges.
- a single Ethernet interface (specified as ethn).
- a comma-separated list of Ethernet interfaces. Ethernet port numbers start at eth0 and end at eth*n*, where *n* is the highest numbered Ethernet port.
- the Ethernet interface eth0.

By default, LLDP management address advertisement is enabled for all ports.

Examples To enable management address advertisement on ports 1 and 2, use the command:

```
ena lldp mana po=1,2
```

To enable management address advertisement on all ports, use one of the commands:

```
ena lldp mana
ena lldp mana po=all
```

See Also **disable lldp managementaddress**
enable lldp port
set lldp managementaddress
show lldp

enable lldp notifications

Syntax `ENAble LLDP NOTIfications [POrt={ALL|`*`port-list`*`}]`

Description This command enables the switch to send LLDP SNMP notifications from the specified ports. Notifications are SNMP traps, triggers, and logs.

Use the **port** parameter to specify the ports for which to enable LLDP notifications, either a list of ports or all ports. *port-list* can be any/all of the following:

- a single switch port number. Port numbers start at 1 and end at *m*, where *m* is the highest numbered port.
- a range of switch port numbers (specified as *n-m*).
- a comma-separated list of switch port numbers and/or ranges.
- a single Ethernet interface (specified as ethn).
- a comma-separated list of Ethernet interfaces. Ethernet port numbers start at eth0 and end at eth*n*, where *n* is the highest numbered Ethernet port.
- the Ethernet interface eth0.

By default, LLDP notifications are disabled for all ports.

To set the amount of time between notifications, use **set lldp notification interval** command on page 26.

Examples To enable LLDP notifications from ports 1 and 2, use the command:

```
ena lldp noti po=1,2
```

To enable LLDP notifications from all ports, use one of the commands:

```
ena lldp noti
```

```
ena lldp noti po=all
```

See Also
disable lldp notifications
enable lldp port
set lldp notification interval
show lldp

enable lldp port

Syntax `ENAble LLDP POrt={ALL|`*`port-list`*`} [{TX|RX|TXRX}]`

Description This command enables the specified LLDP actions on the specified ports, either **tx** (transmission), **rx** (reception), or **txrx** (both). By default, all LLDP actions are disabled for all ports.

Parameter	Description	
POrt	The ports for which to enable the specified LLDP actions, either a list of ports or all ports. *port-list* can be any/all of the following: • a single switch port number. Port numbers start at 1 and end at *m*, where *m* is the highest numbered port. • a range of switch port numbers (specified as *n-m*). • a comma-separated list of switch port numbers and/or ranges. • a single Ethernet interface (specified as ethn). • a comma-separated list of Ethernet interfaces. Ethernet port numbers start at eth0 and end at eth*n*, where *n* is the highest numbered Ethernet port. • the Ethernet interface eth0. Default: **all**.	
TX|RX|TXRX	Specify:	To:
	TX	Allow the LLDP agent to **transmit** LLDPDUs on the specified ports.
	RX	Allow the LLDP agent to **receive** LLDPDUs on the specified ports.
	TXRX	Allow the LLDP agent to both **transmit and receive** LLDPDUs on the specified ports.
	Default: **TXRX**	

Examples To enable the transmission of LLDPDUs from all ports, use the command:

```
ena lldp po tx
```

To enable both the transmission and reception of LLDPDUs on ports 1 to 3, use one of the commands:

```
ena lldp po=1-3
ena lldp po=1-3 txrx
```

See Also **disable lldp port**
purge lldp
reset lldp
show lldp

enable lldp portdescription

Syntax `ENAble LLDP PORTDescription [POrt={ALL|`*`port-list`*`}]`

Description This command enables port description TLV advertisement on the specified ports. The IEEE 802 LAN station's port description that is associated with the local system. You can set this using the **set switch port description** command. Note that you cannot set an Ethernet port's description, because Ethernet ports are static.

The LLDP agent now includes port description information in any LLDPDUs it sends.

Use the **port** parameter to specify the ports for which to enable port description TLV advertisement, either a list of ports or all ports. *port-list* can be any/all of the following:

- a single switch port number. Port numbers start at 1 and end at *m*, where *m* is the highest numbered port.
- a range of switch port numbers (specified as *n-m*).
- a comma-separated list of switch port numbers and/or ranges.
- a single Ethernet interface (specified as ethn).
- a comma-separated list of Ethernet interfaces. Ethernet port numbers start at eth0 and end at eth*n*, where *n* is the highest numbered Ethernet port.
- the Ethernet interface eth0.

By default, LLDP port description advertisement is enabled for all ports.

Examples To enable port description advertisement on port 1 and 2, use the command:

```
ena lldp portd po=1,2
```

To enable port description advertisement on all ports, use one of the commands:

```
ena lldp portd
```

```
ena lldp portd po=all
```

See Also **disable lldp portdescription**
enable lldp port
set switch port
show lldp

enable lldp systemcapabilities

Syntax `ENAble LLDP SYSTEMCapabilities [POrt={ALL|`*`port-list`*`}]`

Description This command enables system capabilities TLV advertisement on the specified ports. System capabilities are the primary functions of your system, including bridge and/or switch. The LLDP agent now includes system capabilities information in any LLDPDUs it sends.

Use the **port** parameter to specify the ports for which to enable system capability TLV advertisement, either a list of ports or all ports. *port-list* can be any/all of the following:

- a single switch port number. Port numbers start at 1 and end at *m*, where *m* is the highest numbered port.
- a range of switch port numbers (specified as *n-m*).
- a comma-separated list of switch port numbers and/or ranges.
- a single Ethernet interface (specified as ethn).
- a comma-separated list of Ethernet interfaces. Ethernet port numbers start at eth0 and end at eth*n*, where *n* is the highest numbered Ethernet port.
- the Ethernet interface eth0.

By default, LLDP system capabilities advertisement is enabled for all ports.

Examples To enable system capabilities advertisement on ports 1 and 2, use the command:

```
ena lldp systemc po=1,2
```

To enable system capabilities advertisement on all ports, use one of the commands:

```
ena lldp systemc
```

```
ena lldp systemc po=all
```

See Also **disable lldp systemcapabilities**
enable lldp port
show lldp

enable lldp systemdescription

Syntax `ENAble LLDP SYSTEMDescription [POrt={ALL|`*`port-list`*`}]`

Description This command enables system description TLV advertisement on the specified ports. This is the description of the local system, and is displayed in output of the **show system** command.

The LLDP agent now includes system description information in any LLDPDUs it sends.

Use the **port** parameter to specify the ports for which to enable system description TLV advertisement, either a list of ports or all ports. *port-list* can be any/all of the following:

- a single switch port number. Port numbers start at 1 and end at *m*, where *m* is the highest numbered port.
- a range of switch port numbers (specified as *n-m*).
- a comma-separated list of switch port numbers and/or ranges.
- a single Ethernet interface (specified as ethn).
- a comma-separated list of Ethernet interfaces. Ethernet port numbers start at eth0 and end at eth*n*, where *n* is the highest numbered Ethernet port.
- the Ethernet interface eth0.

By default, LLDP system description advertisement is enabled for all ports.

Examples To enable system description advertisement on port 1 and 2, use the command:

```
ena lldp systemd po=1,2
```

To enable system description advertisement on all ports, use one of the commands:

```
ena lldp systemd
```

```
ena lldp systemd po=all
```

See Also **disable lldp systemdescription**
enable lldp port
show lldp

enable lldp systemname

Syntax `ENAble LLDP SYSTEMName [POrt={ALL|`*`port-list`*`}]`

Description This command enables system name TLV advertisement on the specified ports. The LLDP agent now includes local system name information in any LLDPDUs it sends.

Use the **port** parameter to specify the ports for which to enable system name TLV advertisement, either a list of ports or all ports. *port-list* can be any/all of the following:

- a single switch port number. Port numbers start at 1 and end at *m*, where *m* is the highest numbered port.
- a range of switch port numbers (specified as *n-m*).
- a comma-separated list of switch port numbers and/or ranges.
- a single Ethernet interface (specified as ethn).
- a comma-separated list of Ethernet interfaces. Ethernet port numbers start at eth0 and end at eth*n*, where *n* is the highest numbered Ethernet port.
- the Ethernet interface eth0.

By default, LLDP system name advertisement is enabled for all ports.

Examples To enable system name advertisement on port 1 and 2, use the command:

```
ena lldp systemn po=1,2
```

To enable system name advertisement on all ports, use one of the commands:

```
ena lldp systemn
ena lldp systemn po=all
```

See Also **disable lldp systemname**
enable lldp port
show lldp

purge lldp

Syntax `PURge LLDP`

Description This command clears your existing LLDP configuration information and all remote LLDP MIB data. LLDP reverts to its default configuration, which means that LLDP is disabled for all ports.

This command does not reset LLDP MIB counters because these counters cannot be reset.

Example To purge your LLDP configuration and remote LLDP data, and restore the default values, use the command:

```
pur lldp
```

See Also **reset lldp**
show lldp

reset lldp

Syntax `RESET LLDP`

Description This command clears all your remote LLDP MIB data, and starts the LLDP re-initialization procedure. LLDP reverts to the previous, user-defined configuration.

This command does not reset LLDP MIB counters because these counters cannot be reset.

Example To clear your remote LLDP MIB data and reset your LLDP configuration, use the command:

```
reset lldp
```

See Also **purge lldp**
show lldp

set lldp managementaddress

Syntax `SET LLDP MANAgementaddress=`*`ipadd`*

Description This command sets an IPv4 address value to advertise for your local LLDP agent's management address.

The **managementaddress** parameter specifies the IPv4 management address that is advertised for your local LLDP agent. If you do not set this parameter, the management address that is advertised is the MAC address of the switch. ipadd is an IP version 4 address in dotted decimal notation.

By default, LLDP management address advertisement is enabled for all ports. To disable it, use the **disable lldp managementaddress** command.

Examples To set the management address to 192.168.0.1, use the command:

```
set lldp mana=192.168.0.1
```

See Also **disable lldp managementaddress**
enable lldp managementaddress
show lldp

set lldp notification interval

Syntax `SET LLDP NOTIFicationinterval=5..3600`

Description This command sets the amount of time between LLDP notifications. Notifications include SNMP traps, log messages and triggers.

The **notificationinterval** parameter is the number of seconds to elapse between LLDP notifications.The notification interval prevents multiple notifications occurring within the given time. The default is 5.

By default, all LLDP notifications are disabled. To enable them, use the **enable lldp notifications** command.

Example To set the LLDP notification interval to 10 seconds, use the command:

```
set lldp notif=10
```

See Also **disable lldp notifications**
enable lldp notifications
set lldp reinitdelay
set lldp txdelay
set lldp txhold
set lldp txinterval
show lldp

set lldp reinitdelay

Syntax `SET LLDP REINITdelay=1..10`

Description This command sets the LLDP re-initialization delay.

The **reinitdelay** parameter specifies the number of seconds that the switch waits after a port's status becomes disabled before it begins the LLDP re-initialization process. The default is 2.

Example To set the re-initialization delay to 5 seconds, use the command:

```
set lldp reinit=5
```

See Also **set lldp txdelay**
set lldp txhold
set lldp txinterval
show lldp

set lldp txdelay

Syntax `SET LLDP TXDelay=1..8192`

Description This command changes the default time delay between successive LLDP transmissions initiated by value or status changes in the local LLDP MIB. For more information, see Transmission delay timer on page 5.

This is the LLDP MIB object **lldpTxDelay.** For more information, see Section 12 of the IEEE Standard 802.1AB-2005.

The **txdelay** parameter is the number of seconds that the switch waits between transmitting successive LLDPDUs, when those LLDPDUs are initiated by value or status changes in the local LLDP MIB. The default is 2. Changing the default can affect LLDP operation.

Example To set the transmission delay to 10 seconds, use the command:

```
set lldp txd=10
```

See Also
set lldp reinitdelay
set lldp txhold
set lldp txinterval
show lldp

set lldp txhold

Syntax `SET LLDP TXHold=2..10`

Description This command changes the default value of the LLDP MIB object **lldpMessageTxHoldMultiplier**. For more information, see Section 12 of the IEEE Standard 802.1AB-2005.

The **txhold** parameter specifies the multiplier on the **msgTxInterval** parameter of the **set lldp txinterval** command. The default is 4. Changing the default can affect LLDP operation.

Example To set the txhold value to 8, use the command:

```
set lldp txh=8
```

See Also **set lldp reinitdelay**
set lldp txdelay
set lldp txinterval
show lldp

set lldp txinterval

Syntax `SET LLDP TXInterval=5..32768`

Description This command sets the time interval between LLDP transmissions. This is the LLDP MIB object **lldpMessageTxInterval.** For more information, see Section 12 of the IEEE Standard 802.1AB-2005.

The **txinterval** parameter specifies the number of seconds that the switch transmits LLDPDUs on behalf of the LLDP agent. The default is 30. Note that changing the default can affect LLDP operation.

Example To set the LLDP to transmit LLDPDUs every 100 seconds, use the command:

```
set lldp txi=100
```

See Also **set lldp reinitdelay**
set lldp txdelay
set lldp txhold
show lldp

show lldp

Syntax `SHow LLDP [LOCALData] [POrt={ALL|`*`port-list`*`}] [DETail]`

Description This command displays information about your LLDP configuration. If no optional parameters are specified, the global LLDP configuration is displayed.

Parameter	Description
LOCALData	Displays additional LLDP local system data for the specified ports, or all ports if you do not specify the **port** parameter.
POrt	The ports for which to display LLDP information, either a list of ports or all ports. *port-list* can be any/all of the following: • a single switch port number. Port numbers start at 1 and end at *m*, where *m* is the highest numbered port. • a range of switch port numbers (specified as *n-m*). • a comma-separated list of switch port numbers and/or ranges. • a single Ethernet interface (specified as ethn). • a comma-separated list of Ethernet interfaces. Ethernet port numbers start at eth0 and end at eth*n,* where *n* is the highest numbered Ethernet port. • the Ethernet interface eth0. Default: **all**
DETail	Displays additional, detailed LLDP port configuration information about the specified ports (Figure 3, Table 1).

Figure 1: Example output from the **show lldp port** command

```
LLDP configuration

LLDP global configuration:
  msgTxInterval ......................... 30
  msgTxHold ............................. 4
  reinitDelay ........................... 2
  txDelay ............................... 2
  Notification interval ................. 5
  Management address .................... 00-09-41-4c-d0-18
  Total current neighbours .............. 0
  Too many neighbours events ............ 0
  System errors ......................... 0

LLDP port configuration:
Port      adminStatus    Notifications  LLDP TLVs
-------------------------------------------------------------
1         txOnly         enabled        PD SN SD SC MA
2         rxOnly         disabled       -  -  -  -  -
3         txAndRx        enabled        PD SN SD SC -
4         disabled       enabled        PD SN SD SC MA
5         txAndRx        disabled       PD SN SD SC MA
eth0      disabled       disabled       PD SN SD SC MA
eth1      disabled       disabled       PD SN SD SC MA

Key:
  PD ........ Port description
  SN ........ System name
  SD ........ System description
  SC ........ System capabilities
  MA ........ Management address
```

Figure 2: Example output from the **show lldp localdata port=1,2** command

```
LLDP configuration

LLDP global configuration:
  msgTxInterval ....................... 30
  msgTxHold ........................... 4
  reinitDelay ......................... 2
  txDelay ............................. 2
  Notification interval ............... 5
  Management address .................. 00-09-41-4c-d0-18
  Total current neighbours ............ 0
  Too many neighbours events .......... 0
  System errors ....................... 0

 LLDP local system data:
  lldpLocChassisIdSubtype ............. 4
  lldpLocChassisId .................... 00-09-41-4c-d0-18
  lldpLocSysName ...................... AR450
  lldpLocSysDesc ...................... Allied Telesis AR450 version 2.9.1-00
                                        30-Dec-2006
  lldpLocSysCapSupported .............. Bridge, Router
  lldpLocSysCapEnabled ................ Bridge, Router

  lldpLocManAddrTable:
    lldpLocManAddrSubtype ............. 6
    lldpLocManAddr ..................... 00-09-41-4c-d0-18
    lldpLocManAddrLen ................. 7
    lldpLocManAddrIfSubtype ........... 1
    lldpLocManAddrOID ................. -

  lldpLocPortTable:
    Port 1:
      LLDP:
        lldpLocPortIdSubtype ........... 5
        lldpLocPortId ................. port1
        lldpLocPortDesc ............... port1

    Port 2:
      LLDP:
        lldpLocPortIdSubtype ........... 5
        lldpLocPortId ................. port2
        lldpLocPortDesc ............... port2

LLDP port configuration:
.
.
.
```

Figure 3: Example output from the **show lldp port=1,3 detail** command

```
LLDP configuration

LLDP global configuration:
  msgTxInterval ..................... 30
  msgTxHold ......................... 4
  reinitDelay ....................... 2
  txDelay ........................... 2
  Notification interval ............. 5
  Management address ................ 00-09-41-4c-d0-18
  Total current neighbours .......... 0
  Too many neighbours events ........ 0
  System errors ..................... 0

LLDP port configuration:
  Port 1:
    Admin status .................... txOnly
    Notifications ................... enabled
    LLDP optional TLVs:
      Port description .............. advertise
      System name ................... advertise
      System description ............ advertise
      System capabilities ........... advertise
      Management address ............ advertise

  Port 2:
    Admin status .................... rxOnly
    Notifications ................... disabled
    LLDP optional TLVs:
      Port description .............. not advertise
      System name ................... not advertise
      System description ............ not advertise
      System capabilities ........... not advertise
      Management address ............ not advertise
```

Table 1: Parameters in output of the **show lldp** command

Parameter	Meaning
LLDP global configuration	
msgTxInterval	The time interval in seconds between which the switch transmits LLDPDUs on behalf of the LLDP agent. You can set this using the **set lldp txinterval** command.
msgTxHold	The current multiplier on **msgTxInterval**. You can set this using the **set lldp txhold** command.
reinitDelay	The time in seconds that the switch waits after a port is disabled, before it begins the LLDP re-initialization process. You can set this using the **set lldp reinitdelay** command.
txDelay	The time in seconds, that the switch waits between transmitting successive LLDPDUs initiated by value or status changes in the local LLDP MIB. You can set this using the **set lldp txdelay** command.
Notification interval	The time in seconds that elapses between LLDP notifications. You can set this using the **set lldp notification interval** command.
Management address	The IPv4 management address the switch advertises for your local LLDP agent. You can set this using the **set lldp managementaddress** command.
Total current neighbours	The total number of active neighbours that are currently associated with your local system.
Too many neighbours events	The number of times the toomanyneighbours event has occurred since the last LLDP re-initialization.
System errors	Major LLDP system errors that could affect LLDP operation. If a number greater than 0 is displayed, contact your System Administrator.
LLDP port configuration	
Port	The port number.
adminStatus	The LLDP transmission and reception status of the port, one of: • **txOnly** Transmission is enabled only • **rxOnly** Reception is enabled only • **txAndrx** Both transmission and reception are enabled • **disabled** Both transmission and reception are disabled You can enable a value of **txOnly**, **rxOnly**, or **txAndrx** for the port using the **enable lldp port** command. You can disable **txOnly**, **rxOnly**, or **txAndrx for** the port using the **disable lldp port** command.
Notifications	The current notifications setting, either 'enabled' or 'disabled'. You can set this using the **disable lldp notifications** or **enable lldp notifications** commands.

Table 1: Parameters in output of the **show lldp** command (cont.)

Parameter	Meaning
LLDP TLVs	A list of the LLDP optional TLVs currently advertised on the listed ports, one or more of: • PD - Port Description • SN - System Name • SD - System Description • SC - System Capabilities • MA - Management Address
LLDP local system data	
This section is displayed only when you specify the **localdata** parameter.	
lldpLocChassisIdSubtype	The type of encoding used to identify the chassis associated with your local system.
lldpLocChassisId	The chassis ID associated with your local system. This is the MAC address.
lldpLocSysName	The system name of your local system.
lldpLocSysDesc	A textual description of your local system, including the full name and version identification of your system's hardware type, software operating system, and networking software.
lldpLocSysCapSupported	The system's currently supported primary functions.
lldpLocSysCapEnabled	The system's currently enabled primary functions.
lldpLocManAddrTable	
LLDP local management address MIB information. This is displayed only when you have both set and enabled an LLDP management address.	
lldpLocManAddrSubtype	The type of encoding used to identify the management address associated with your local system.
lldpLocManAddr	The IPv4 management address that is currently set for your local system. To set a management address, use the **set lldp managementaddress** command.
lldpLocManAddrLen	The total combined length of the management address subtype field, and the management address field in LLDPDUs transmitted by your local LLDP agent.
lldpLocManAddrIfSubtype	The interface numbering method used to define the interface number associated with your local system.
lldpLocManAddrOID	Currently unsupported.
lldpLocPortTable	
LLDP port information.	
LLDP	LLDP standard TLV configuration.
lldpLocPortIdSubtype	The type of encoding used to identify the port identifier associated with your local system.
lldpLocPortId	The port identification for the specified port in your local system.
lldpLocPortDesc	The IEEE 802 LAN station's port description associated with your local system.
LLDP port configuration	
This section is displayed only when you specify the **detail** parameter.	
Port	The port number.

Table 1: Parameters in output of the **show lldp** command (cont.)

Parameter	Meaning
adminStatus	The LLDP transmission and reception status of the port, one of: • **txOnly** Transmission is enabled only • **rxOnly** Reception is enabled only • **txAndrx** Both transmission and reception are enabled • **disabled** Both transmission and reception are disabled You can enable a value of **txOnly**, **rxOnly**, or **txAndrx** for the port using the **enable lldp port** command. You can disable **txOnly**, **rxOnly**, or **txAndrx for** the port using the **disable lldp port** command.
Notifications	The current notifications setting, either 'enabled' or 'disabled'. You can set this using the **disable lldp notifications** or **enable lldp notifications** commands.
LLDP optional TLVs	
Port description	The port description TLV advertisement status, either 'advertise' or 'not advertise'.You can set this using the **disable lldp portdescription** or **enable lldp portdescription** commands.
System name	The system name TLV advertisement status, either 'advertise' or 'not advertise'.You can set this using the **disable lldp systemname** or **enable lldp systemname** commands.
System description	The system description TLV advertisement status, either 'advertise' or 'not advertise'.You can set this using the **disable lldp systemdescription** or **enable lldp systemdescription** commands.
System capabilities	The system capabilities TLV advertisement status, either 'advertise' or 'not advertise'.You can set this using the **disable lldp systemcapabilities** and **enable lldp systemcapabilities** commands.
Management address	The management address TLV advertisement status, either 'advertise' or 'not advertise'.You can set this using the **disable lldp managementaddress** or **enable lldp managementaddress** commands.

Examples

To display the LLDP configuration information about port 1 and 3 in detail, use the command:

```
sh lldp po=1,3 det
```

To display the LLDP configuration information with local system data about port 1 to 3 in summary, use the command:

```
sh lldp locald po=1,3
```

See Also

disable lldp port
enable lldp port
show lldp counters
show lldp neighbour

show lldp counters

Syntax `SHow LLDP COUnters [POrt={ALL|`*port-list*`}] [DETail]`

Description This command displays information about LLDP counters in your configuration. If no optional parameters are specified, global LLDP counters are displayed. For information about LLDP counters, see the IEEE Standard 802.1AB-2005.

Parameter	Description
POrt	The ports for which to display LLDP counter information, either a list of ports or all ports. *port-list* can be any/all of the following: • a single switch port number. Port numbers start at 1 and end at *m*, where *m* is the highest numbered port. • a range of switch port numbers (specified as *n-m*). • a comma-separated list of switch port numbers and/or ranges. • a single Ethernet interface (specified as ethn). • a comma-separated list of Ethernet interfaces. Ethernet port numbers start at eth0 and end at eth*n*, where *n* is the highest numbered Ethernet port. • the Ethernet interface eth0. Default: **all**
DETail	Specify **detail** to display additional, detailed LLDP counter information about the specified ports or all ports.

Figure 4: Example output from the **show lldp counters port=1,2** command

```
LLDP counters information

LLDP statistics group:
  Remote tables last change time ..... 00:10:33 (63350)
  Remote tables inserts ................. 1
  Remote tables deletes ................. 0
  Remote tables drops ................... 0
  Remote tables ageouts ................. 0

LLDP frame statistics summary:
Port     Tx total      Rx total      Rx discards    Rx errors
-------------------------------------------------------------
1         120            0              0              0
2         0              1              0              0
```

Figure 5: Example output from the **show lldp counters port=1,2 detail** command

```
LLDP counters information

LLDP statistics group:
  Remote tables last change time ..... 00:12:30 (75038)
  Remote tables inserts ................. 1
  Remote tables deletes ................. 0
  Remote tables drops ................... 0
  Remote tables ageouts ................. 0

LLDP port statistics:
  Port 1:
    framesIn ..................... 0    framesOut ...... 120
    framesDiscarded .............. 0
    framesInErrors ............... 0
    ageouts ...................... 0
    TLVsDiscarded ................ 0
    TLVsUnrecognized ............. 0

  Port 2:
    framesIn ..................... 1    framesOut ....... 0
    framesDiscarded .............. 0
    framesInErrors ............... 0
    ageouts ...................... 0
    TLVsDiscarded ................ 0
    TLVsUnrecognized ............. 0
```

Table 2: Parameters in output of the **show lldp counters** command

Parameter	Meaning
LLDP statistics group	
A list of counters for remote MIB table information.	
Remote tables last change time	The time of the most recent change to the remote table, or when an entry was last created, modified, or deleted.
Remote tables inserts	The number of times that a complete set of information advertised by a neighbour has been inserted into the table.
Remote tables deletes	The number of times that a complete set of information advertised by a neighbour has been deleted from the table.
Remote tables drops	The number of times that a complete set of information advertised by a neighbour could not be inserted into the table.
Remote tables ageouts	The number of times that a complete set of information advertised by a neighbour has been removed from the table because its TTL has expired.
LLDP frame statistics summary	
A list of LLDP counters for each specified LLDP port.	
Port	The port number.
TX total	The total number of LLDPDUs transmitted through the port.
Rx total	The total number of LLDPDUs received by the port.
Rx discards	The total number of LLDPDUs received and subsequently discarded.
Rx errors	The total number of LLDPDUs received by the port with one or more detectable errors.

Table 2: Parameters in output of the **show lldp counters** command (cont.)

Parameter	Meaning
LLDP port statistics	
A list of LLDP frame counters for each specified LLDP port.	
framesIn	The total number of LLDP frames received by the port.
framesOut	The total number of LLDP frames transmitted from the port.
framesDiscarded	The total number of LLDP frames received and subsequently discarded.
framesInErrors	The total number of LLDP frames that were received by the port with one or more detectable errors.
ageouts	The total number of times that the switch deleted a neighbour's information from the LLDP remote systems MIB because that neighbour's time-to-live has expired.
TLVsDiscarded	The total number of TLVs that were received by the port and subsequently discarded.
TLVsUnrecognized	The total number of TLVs that the receiving LLDP local agent did not recognize.

Examples To display counter information for ports 1 and 3 in a summary table, use the command:

```
sh lldp cou po=1,3
```

To display detailed counter information for port 1, use the command:

```
sh lldp cou po=1 det
```

See Also
disable lldp port
enable lldp port
show lldp
show lldp neighbour

show lldp memory

Syntax `SHow LLDP MEMory`

Description This command displays the available memory for LLDP, the total memory usage by LLDP as a whole, and the amount of memory used by the remote systems MIB. This information is displayed both in kbps and as a percentage.

To prevent the remote systems MIB from using large amounts of memory and possibly affecting the operation of your switch, the total size of the MIB is set to be a maximum of 5MB, or 5% of your available memory - whichever is the lesser amount.

Figure 6: Example output from the **show lldp memory** command

```
LLDP memory information

Total LLDP memory available ..... 5120 (KB)
Total LLDP memory usage ................. 4 (KB) (0%)
LLDP remote systems MIB usage ........... 0 (KB) (0%)
```

Table 3: Parameters in output of the **show lldp memory** command

Parameter	Meaning
Total LLDP memory available	The total memory space in Kbps that is currently available for LLDP.
Total LLDP memory usage	The total memory space in Kbps that LLDP is currently using, followed by its usage expressed as a percentage of the total LLDP memory.
LLDP remote systems MIB usage	The total memory space in Kbps that the LLDP remote systems MIB is currently using, followed by its usage expressed as a percentage of the total LLDP memory. If this counter shows that the maximum of 5% or 5MB is being reached often, consider deactivating LLDP reception on some ports.

Example To display information about LLDP memory, use the command:

```
sh lldp mem
```

See Also **purge lldp**
reset lldp
show lldp

show lldp neighbour

Syntax `SHow LLDP NEIghbour [POrt={ALL|`*`port-list`*`}] [DETail]`

Description This command displays information about neighbours discovered on the specified ports. If no optional parameters are specified, information about all LLDP neighbours is displayed.

Parameter	Description
POrt	The ports for which to display LLDP neighbour information, either a list of ports or all ports. *port-list* can be any/all of the following: • a single switch port number. Port numbers start at 1 and end at *m*, where *m* is the highest numbered port. • a range of switch port numbers (specified as *n-m*). • a comma-separated list of switch port numbers and/or ranges. • a single Ethernet interface (specified as ethn). • a comma-separated list of Ethernet interfaces. Ethernet port numbers start at eth0 and end at eth*n,* where *n* is the highest numbered Ethernet port. • the Ethernet interface eth0. Default: **all**.
DETail	Specify **detail** to display additional, detailed LLDP neighbour information about the specified ports or all ports.

Figure 7: Example output from the **show lldp neighbour port=1,2** command

```
LLDP neighbour information

Port 1:
There are no neighbours for this port.

Port 2:
remoteIndex    timeMark  chassisId               sysName
-------------------------------------------------------------
1              89148     00-30-84-6e-ba-c2       switch1
```

Figure 8: Example output from the **show lldp neighbour port=1,2 detail** command

```
LLDP neighbour information

Neighbour information for port 1:
There are no neighbours for this port.

Neighbour information for port 2:

Remote index 1:
  lldpRemTable:
    lldpRemLocalPortNum ................. 2
    lldpRemIndex ........................ 1
    lldpRemTimeMark ..................... 89148
    lldpRemChassisIdSubtype ............. 4
    lldpRemChassisId .................... 00-30-84-6e-ba-c2
    lldpRemPortIdSubtype ................ 5
    lldpRemPortId ....................... port1
    lldpRemPortDesc ..................... port1
    lldpRemSysName ...................... switch1
   lldpRemSysDesc ....................... Allied telesis AR450
                                          version 2.9.1
                                          30-Oct-2005
    lldpRemSysCapSupported .............. Bridge, Router
    lldpRemSysCapEnabled ................ Bridge
    Time to live ........................ 120

  lldpRemManAddrTable:
    lldpRemManAddrSubtype ............... 1
    lldpRemManAddr ...................... 192.168.1.200
    lldpRemManAddrIfSubtype ............. 2
    lldpRemManAddrIfId .................. 1
    lldpRemManAddrOID ................... -

  lldpRemOrgDefInfoTable:
    lldpRemOrgDefInfoOUI ................ 00-80-C2
    lldpRemOrgDefInfoSubtype ............ 1
    lldpRemOrgDefInfoIndex .............. 1
    lldpRemOrgDefInfo ...................

    lldpRemOrgDefInfoOUI ................ 00-80-C2
    lldpRemOrgDefInfoSubtype ............ 2
    lldpRemOrgDefInfoIndex .............. 2
    lldpRemOrgDefInfo ................... 00

    lldpRemOrgDefInfoOUI ................ 00-80-C2
    lldpRemOrgDefInfoSubtype ............ 3
    lldpRemOrgDefInfoIndex .............. 3
    lldpRemOrgDefInfo ................... 000105766c61

    lldpRemOrgDefInfoOUI ................ 00-80-C2
    lldpRemOrgDefInfoSubtype ............ 4
    lldpRemOrgDefInfoIndex .............. 4
    lldpRemOrgDefInfo ................... 0354
```

Table 4: Parameters in output of the **show lldp neighbour** command

Parameter	Meaning
remoteIndex	A unique neighbour identity assigned to each neighbour added to the remote system MIBs.
timeMark	The number of centiseconds since this neighbour was added.
chassisId	The chassis identity of the neighbour.
sysName	The system name of the neighbour's system.
lldpRemTable	
This information is displayed when you enter the **detailed** parameter.	
lldpRemLocalPortNum	The number of the neighbour's port from which the LLDPDU was sent.
lldpRemIndex	A unique neighbour identity. This is assigned to each neighbour added to the remote system MIBs.
lldpRemTimeMark	The number of centiseconds since this neighbour was added.
lldpRemChassisIdSubtype	The type of encoding used to identify the neighbour's chassis.
lldpRemChassisId	The ID number of the neighbour's chassis.
lldpRemPortIdSubtype	The type of port identifier encoding used for the neighbour's port from which the LLDPDU was sent.
lldpRemPortId	The neighbour's port from which the LLDPDU was sent.
lldpRemPortDesc	A description of the neighbour's port from which the LLDPDU was sent.
lldpRemSysName	The system name of the neighbour's system.
lldpRemSysDesc	The system description of the neighbour's system.
lldpRemSysCapSupported	The system capabilities that are supported on the neighbour's system.
lldpRemSysCapEnabled	The system capabilities that are enabled on the neighbour's system.
Time to live	The number of seconds for which your LLDP agent will regard the neighbour's information as valid.
ldpRemManAddrTable	
lldpRemManAddrSubtype	The type of management address identifier encoding used for the neighbour's defined Management Address.
lldpRemManAddr	The neighbour's defined Management Address.
lldpRemManAddrIfSubtype	The interface numbering method used to define the interface name associated with the neighbour.
lldpRemManAddrIfId	The interface number for the management address component associated with the neighbour.
lldpRemManAddrOID	The type of hardware component or protocol entity associated with the neighbour's management address.
lldpRemOrgDefInfoTable	
lldpRemOrgDefInfoOUI	A globally unique assigned Organisationally Unique Identifier (OUI) number for the information received from the neighbour.

Table 4: Parameters in output of the **show lldp neighbour** command (cont.)

Parameter	Meaning
lldpRemOrgDefInfoSubtype	The subtype of the organisationally defined information received from the neighbour.
lldpRemOrgDefInfoIndex	An arbitrary local integer value used by your LLDP agent to identify a particular, unrecognized, organisationally defined information instance.
lldpRemOrgDefInfo	The organisationally defined information associated with the neighbour.

For more information about LLDP parameters, see the IEEE Standard 802.1AB-2005.

Examples To display the neighbour information for port 1 and 2 in detail, use the command:

```
sh lldp nei po=1,2 det
```

To display the neighbour information for all ports in summary, use one of the commands:

```
sh lldp nei
```

```
sh lldp nei port=all
```

See Also
disable lldp port
enable lldp port
show lldp
show lldp counters

MAC-Forced Forwarding

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Introduction

This chapter describes MAC-Forced Forwarding, how it is implemented, and how to configure it on the switch.

MAC-Forced Forwarding is a method for subscriber separation on a network. It is appropriate for IPv4 Ethernet based networks, where a layer 2 bridged segment separates downstream clients from their upstream IPv4 gateways, known as Access Routers (ARs).

MAC-Forced Forwarding directs all traffic from a client to a specific AR. This stops the clients from having direct access to one another through the bridged segment, despite being within the same subnet.

MAC-Forced Forwarding provides the following benefits to your network:

- The ability to monitor, filter, and police any traffic between separate clients within the same subnet. This allows you to account for all traffic to and from a client.
- Efficient use of limited resources. MAC-Forced Forwarding allows IPv4 addresses to be efficiently assigned by DHCP, and uses less bandwidth and configuration than other Ethernet solutions such as PPPoE.
- Greater security within the subnet. As malicious clients cannot discover the MAC addresses of their neighbouring clients, they cannot launch Ethernet level attacks on these clients.

The switch's implementation of MAC-Forced Forwarding is compatible with RFC 4562 *MAC-Forced Forwarding: A Method for Subscriber Separation on an Ethernet Access Network*.

Overview of MAC-Forced Forwarding

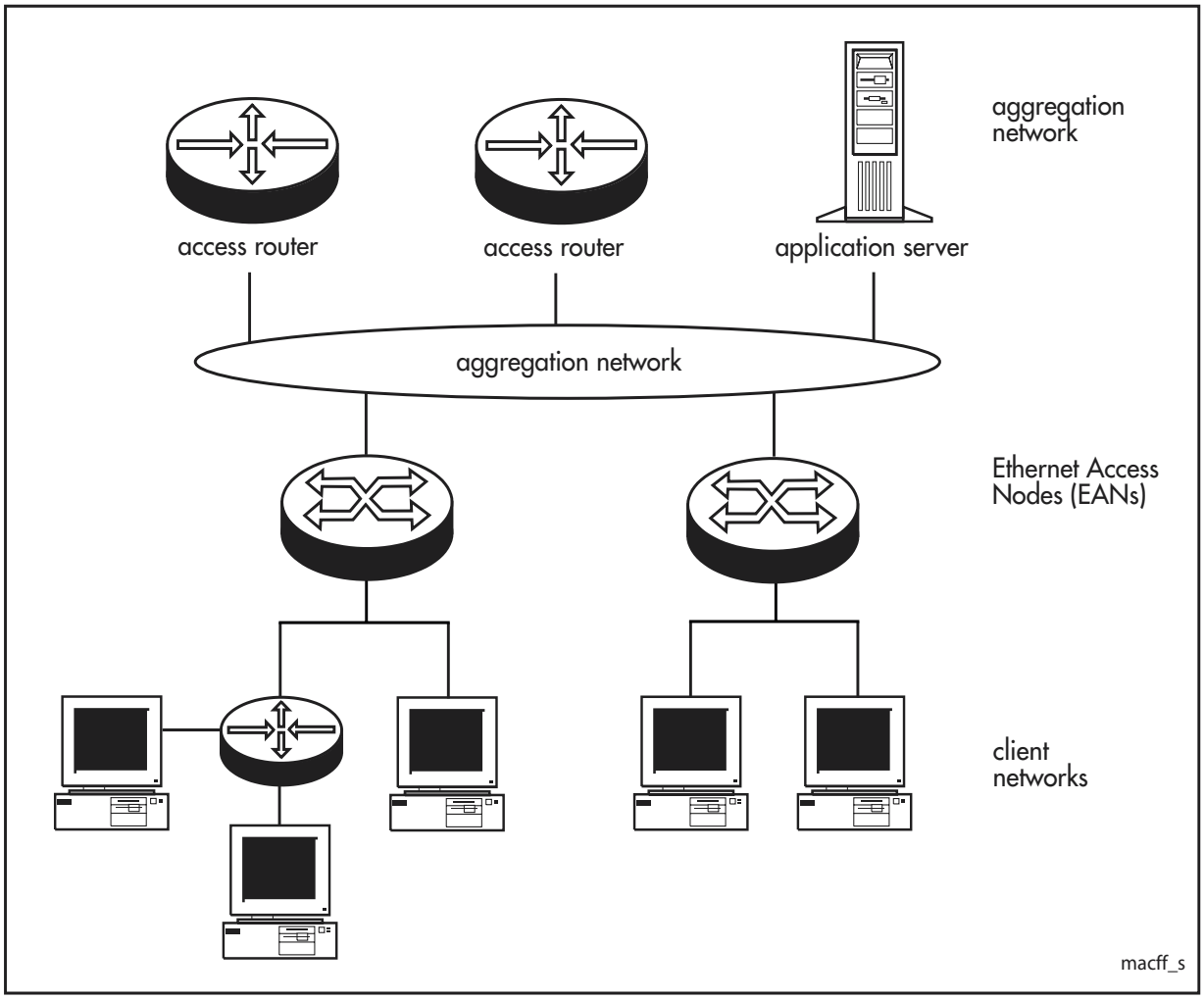
MAC-Forced Forwarding is suitable for Ethernet networks where a layer 2 bridging device, known as an Ethernet Access Node (EAN), connects ARs to their clients. The protocol is implemented on the EANs in a network. Figure 1 on page 3 shows an example network with EANs.

How it works

MAC-Forced Forwarding uses a feature of proxy Address Resolution Protocol (ARP) to stop MAC address resolution between clients. Without MAC-Forced Forwarding, the EANs in a network forward valid ARP messages to the requested destination. With MAC-Forced Forwarding, EANs intercept all ARP messages from clients and send proxy ARP replies on behalf of the client's AR. This stops the clients from learning the MAC addresses of any other devices, and directs all traffic from the client directly to the AR.

An exception to this rule occurs when the network has an Application Server (AS), and the client sends an ARP request for the AS. In these cases the EAN sends a proxy ARP reply back on behalf of the AS rather than the AR.

Figure 1: Example Ethernet network with layer 2 bridging devices separating ARs and their clients



MAC-Forced Forwarding with DHCP snooping

MAC-Forced Forwarding is designed to work in conjunction with DHCP snooping. DHCP snooping looks for DHCP ACK messages sent from DHCP servers to clients. These specify the IP address of a client, and the ARs that the client is allowed to access. Using DHCP snooping, the EAN can dynamically discover the clients and ARs that are attached to the network.

It is possible for a client to have multiple IP addresses, with access rights to different ARs. The EAN keeps track of a client's access rights by comparing the assigned IP address with the valid ARs for that address.

Configuring an Ethernet Access Node

To implement MAC-Forced Forwarding, configure the EAN to:

- isolate clients within a subnet from one another.
  See "Isolating clients using VLANs" on page 4.
- gather the details of any clients, ARs and ASs on the network.
  See "Using the DHCP Snooping Database" on page 5.
- proxy ARP on behalf of ARs and ASs.
  See "Enabling MAC-Forced Forwarding" on page 5.
- prevent malicious spoofing or traffic from clients.
  See "Using DHCP filtering and ARP security" on page 6.

For an example of how to configure the switch to perform MAC-Forced Forwarding, see *How to Use MAC-Forced Forwarding with DHCP Snooping to Create Enhanced Private VLANs.* This How To Note is available from www.alliedtelesis.co.uk/site/solutions/techdocs.asp?area=howto.

Isolating clients using VLANs

To isolate the clients attached to the EAN, you must configure private VLANs. A private VLAN contains switch ports that are isolated from other ports in the VLAN, but can access another network through an uplink port or uplink trunk group. These ports are called *private ports.* Each private VLAN contains private and uplink ports.

When you have configured a private VLAN, the EAN only forwards traffic from a client to the upstream network, regardless of the original destination details. This blocks all direct traffic between private ports. To create private VLANs, follow these steps:

1. **Create the private VLAN.**

   Use the command:

   ```
   create vlan=vlan-name vid=2..4094 private
   ```

2. **Add the uplink port to the private VLAN.**

   Use the command:

   ```
   add vlan={vlan-name|2..4094} port=port-list
       [frame={untagged|tagged}] uplink
   ```

3. **Add the private ports to the private VLAN.**

   Use the command:

   ```
   add vlan={vlan-name|2..4094} port={port-list|all}
       [frame={untagged|tagged}] [group]
   ```

For further information about the behaviour of private VLANs and how to configure them on the EAN, see the *Switching* chapter in your Software Reference.

Using the DHCP Snooping Database

MAC-Forced Forwarding gathers the AR, AS and client details from the DHCP snooping database. DHCP snooping adds entries to this database when:

- a client uses DHCP to obtain an IP address - DHCP snooping checks the DHCP ACK packets sent between the client and its DHCP server
- you configure the entry manually through a DHCP snooping binding entry

To enable DHCP snooping on the EAN, use the command:

```
enable dhcpsnooping
```

You must configure any uplink ports to ARs as trusted ports before DHCP snooping can successfully operate. To add a trusted port, use the command:

```
set dhcpsnooping port={port-list|all} trusted=yes
   [other-options]
```

DHCP snooping plays an integral role in MAC-Forced Forwarding operation. For details about configuring DHCP snooping, see the *DHCP Snooping* chapter in your Software Reference.

Manually adding entries

You can create static entries for clients, ARs and ASs. This allows you to use MAC-Forced Forwarding for clients on the subnet that do not use DHCP for IP address assignment. This also allows you to define any ASs available on the network, as DHCP snooping does not create dynamic entries for ASs.

To add a static client entry, use the command:

```
add dhcpsnooping binding[=macaddr] interface=vlan ip=ipadd
   port=port-number router=[ipadd,ipadd...]
```

To add a static AR or AS entry, use the command:

```
add macff server interface=vlan ipaddress={ipadd}
   [description=desc]
```

Viewing the entries

To view the list of clients in the DHCP snooping database, use the command:

```
show dhcpsnooping database
```

To display the list of ARs and ASs in the database, use the command:

```
show macff database
```

Enabling MAC-Forced Forwarding

To enable the EAN to proxy ARP on behalf of ARs and ASs on a VLAN, use the command:

```
enable macff interface=vlan
```

To disable MAC-Forced Forwarding on a VLAN, use the command:

```
disable macff interface=vlan
```

Using DHCP filtering and ARP security

ARP security

To permit only trusted clients to access the network, you must enable ARP security. This ensures that only the clients listed in the DHCP snooping database can send ARP messages into the network. To enable ARP security, use the command:

```
enable dhcpsnooping arpsecurity
```

For more information, see "DHCP Snooping ARP Security" in the *DHCP Snooping* chapter of your Software Reference.

DHCP filtering

DHCP filtering prevents IP addresses from being falsified or "spoofed". This guarantees that malicious devices cannot avoid detection by spoofing IP addresses that are not actually allocated to them.

On the AT-8600, AT8700XL, and AT-8800, and Rapier Series switches, when DHCP snooping is enabled, the EAN only allows packets to enter via a given port if their source IP address is currently allocated to a client connected to that port. This type of filtering is automatic and does not require any configuration.

You can enhance DHCP filtering so that the switch drops multicast and broadcast packets sent from a client, except for:

- ARP packets
- IGMP Replies and IGMP Leaves packets, when IGMP snooping is enabled
- DHCP packets, when DHCP snooping is enabled

To enable enhanced DHCP filtering, use the command:

```
enable dhcpsnooping strictunicast
```

On the AT-8948, x900-48, and AT-9900 Series switches, to configure DHCP filtering, you must create classifiers and incorporate them into a QoS configuration. To create classifiers, enter one or both of the **dhcpsnooping** options in the command:

```
create classifier=rule-id [macsaddress=dhcpsnooping]
   [ipsaddress=dhcpsnooping]
```

You can treat these classifiers like all other classifiers, and use them as part of any QoS or filtering configuration. See the *Generic Packet Classifier* chapter of your Software Reference for further information about creating classifiers.

To enhance DHCP filtering so that the switch drops all IGMP queries sent from a client, use the command:

```
enable dhcpsnooping strictunicast
```

To filter other multicast and broadcast packets, you must use classifiers.

Monitoring and Troubleshooting

To see a summary of the VLANs with MAC-Forced Forwarding enabled, use the command:

```
show macff [counter]
```

To see details about a specific VLAN, use the command:

```
show macff interface=vlan
```

To see detailed counters for the traffic flowing through a VLAN, or through specific ports on a VLAN, use the command:

```
show macff interface=vlan [port=port-list] counter
```

To see a detailed list of clients in the DHCP snooping database, use the command:

```
show dhcpsnooping database
```

To see a detailed list of the ARs and ASs held in the database, use the command:

```
show macff database
```

Debugging

The MAC-Forced Forwarding debugging feature allows you to generate information useful for troubleshooting VLANs on the EAN. To enable or disable debugging, use the commands:

```
enable macff interface=vlan
   debug={all|arp|dhcp|error|packet|server|trace}

disable macff interface=vlan
   debug={all|arp|dhcp|error|packet|server|trace}
```

Logging

MAC-Forced Forwarding automatically generates log messages to record when:

- an AR or AS is added or removed from the DHCP snooping database
- the MAC address for any routers associated with a client cannot be resolved
- a client ARP request arrives when the client has no ARs associated with it
- a routine poll of the DHCP snooping database shows that an AR or AS is unavailable
- one of the above log types is generating an excessive amount of logs; the log type is temporarily suspended

DHCP snooping also generates log messages that are related to MAC-Forced Forwarding, such as when a client is added to or removed from the DHCP snooping database.

Configuration Examples

For an example of how to configure the switch to perform MAC-Forced Forwarding, see *How to Use MAC-Forced Forwarding with DHCP Snooping to Create Enhanced Private VLANs*. This How To Note is available from www.alliedtelesis.co.uk/site/solutions/techdocs.asp?area=howto.

Command Reference

This section describes the commands available on the switch to configure MAC-Forced Forwarding.

The shortest valid command is denoted by capital letters in the Syntax section. See "Conventions" in *About this Software Reference* in the front of your Software Reference for details of the conventions used to describe command syntax. See *Appendix A, Messages* for a complete list of messages and their meanings.

add macff server

Syntax

```
ADD MACFF SERVER INTerface=vlan IPaddress=ipadd
   [DESCription=desc]
```

Description

This command adds a static AR or AS entry to the DHCP snooping database. MAC-Forced Forwarding sends proxy ARP replies on behalf of devices in this database.

This command requires a user with security officer privilege when the switch is in security mode.

Parameter	Description
INTerface	The interface that the AR or AS is attached to. *vlan* is the name of a VLAN interface such as vlan46 or vlan122.
IPaddress	The IPv4 address of the AR or AS, in dotted decimal notation.
DESCription	An arbitrary description for the AR or AS. This can be between 0 to 255 characters long, and use any printable character.

Examples

To add a new access router called "Primary DHCP Server (Asuka)" with the IP address 192.168.5.1, which is attached to vlan5, use the command:

```
add macff server int=vlan5 ip=192.168.5.1 desc="Primary DHCP
   Server (Asuka)"
```

See Also

delete macff server
set macff server
show macff
show macff interface

delete macff server

Syntax `DELete MACFF SERVER INTerface=`*`vlan`* `IPaddress=`*`ipadd`*

Description This command deletes a static AR or AS entry from the DHCP snooping database. The switch no longer sends proxy ARP replies on behalf of the AR or AS, and clients can no longer access the AR or AS.

This command requires a user with security officer privilege when the switch is in security mode.

Parameter	Description
INTerface	The interface that the AR or AS is attached to. *vlan* is the name of a VLAN interface such as vlan46 or vlan122.
IPaddress	The IPv4 address of the AR or AS, in dotted decimal notation.

Examples To delete an existing application server with the IP address 192.168.5.1, which is attached to vlan5, use the command:

```
del macff server int=vlan5 ip=192.168.5.1
```

See Also **add macff server**
set macff server
show macff

disable macff interface

Syntax `DISable MACFF INTerface=`*`vlan`*

Description This command disables MAC-Forced Forwarding on the specified VLAN. Normal ARP behaviour recommences on this VLAN.

vlan is the name of a VLAN interface such as vlan46 or vlan122. The specified VLAN must be a private VLAN. The switch's default interface, vlan1, is public and cannot have MAC-Forced Forwarding enabled (or disabled) on it.

You must disable MAC-Forced Forwarding debugging on the VLAN before you can disable MAC-Forced Forwarding for that VLAN. Use the **disable macff interface debug** command to disable any debugging.

This command requires a user with security officer privilege when the switch is in security mode.

Examples To disable MAC-Forced Forwarding on vlan12, use the command:

```
dis macff int=vlan12
```

See Also **disable macff interface debug**
enable macff interface debug
enable macff interface
show macff

disable macff interface debug

Syntax

```
DISable MACFF INTerface=vlan
   DEBug={ALL|ARP|DHCP|ERRor|PACKet|SERVER|TRAce}
```

Description

This command disables debugging for MAC-Forced Forwarding. This command requires a user with security officer privilege when the switch is in security mode.

Parameter	Description	
INTerface	The interface that debugging is disabled on. *vlan* is the name of a VLAN interface such as vlan46 or vlan122.	
DEBug	Entering one of the following options disables debugging of: Default: no default	
	ALL	all debugging options.
	ARP	ARP requests made by MAC-Forced Forwarding to ARs and ASs.
	DHCP	information passed to MAC-Forced Forwarding from DHCP snooping.
	ERRor	any errors in MAC-Forced Forwarding processing.
	PACKet	ARP requests processed by MAC-Forced Forwarding, and the ARP replies sent back to clients.
	SERVER	the addition and removal of ARs and ASs.
	TRAce	selected MAC-Forced Forwarding processing.

Examples

To disable MAC-Forced Forwarding server debugging on vlan3, use the command:

```
dis macff int=vlan3 deb=server
```

See Also

disable macff interface
enable macff interface debug
enable macff interface
show macff

enable macff interface

Syntax `ENAble MACFF INTerface=`*`vlan`*

Description This command enables MAC-Forced Forwarding on the specified VLAN. When a client attached to the VLAN sends an ARP request, MAC-Forced Forwarding responds by sending a proxy ARP reply on behalf of the client's AR. This prevents clients from learning the MAC addresses of other clients within their subnet, and ensures that all traffic is routed to a specific AR.

vlan is the name of a VLAN interface such as vlan46 or vlan122. The VLAN specified must be a private VLAN. The switch's default interface, vlan1, is public and cannot have MAC-Forced Forwarding enabled on it.

This command requires a user with security officer privilege when the switch is in security mode.

Examples To enable MAC-Forced Forwarding on vlan12 use the command:

```
ena macff int=vlan12
```

See Also
disable macff interface debug
disable macff interface
enable macff interface debug
show macff
show macff interface
show macff interface counter

enable macff interface debug

Syntax

```
ENAble MACFF INTerface=vlan
   DEBug={ALL|ARP|DHCP|ERRor|PACKet|SERVER|TRAce}
```

Description

This command enables debugging of MAC-Forced Forwarding on the specified VLAN. You can use debugging to find out what information is coming in on a VLAN, when a new client, AR or AS is discovered or deleted, and to do in-depth packet debugging of MAC-Forced Forwarding on your network. You can enable debugging only on one VLAN at a time.

This command requires a user with security officer privilege when the switch is in security mode.

Parameter	Description	
INTerface	The VLAN that this command enables debugging on. *vlan* is the name of a VLAN interface such as vlan46 or vlan122.	
DEBug	Entering one of the following options enables debugging of: Default: no default	
	ALL	all debugging modes.
	ARP	ARP requests made by MAC-Forced Forwarding to ARs and ASs.
	DHCP	information passed to MAC-Forced Forwarding from DHCP snooping.
	ERRor	any errors in MAC-Forced Forwarding processing.
	PACKet	ARP requests processed by MAC-Forced Forwarding, and the ARP replies sent back to clients.
	SERVER	the addition and removal of ARs and ASs.
	TRAce	selected MAC-Forced Forwarding processing.

See *How to Use MAC-Forced Forwarding with DHCP Snooping to Create Enhanced Private VLANs* for examples of MAC-Forced Forwarding debug output. This How To Note is available from www.alliedtelesis.co.uk/site/solutions/techdocs.asp?area=howto.

Examples

To enable MAC-Forced Forwarding ARP debugging on vlan3, use the command:

```
ena macff int=vlan3 deb=arp
```

See Also

disable macff interface debug
enable macff interface
reset macff counter
show macff

reset macff counter

Syntax `RESEt MACFF COUNTer [POrt=`*`port-list`*`]`

Description This command resets all the current MAC-Forced Forwarding counter information for a range of ports, or all ports.

The **port** parameter allows you to select only a subset of ports to reset the counters for. *port-list* is either a specific port, a range of ports using a hyphen to specify the range (n-m), or a comma-separated list of ports or port ranges. Port numbers start at 1 and end at m, where m is the highest numbered switch Ethernet port, including uplink ports.

This command requires a user with security officer privilege when the switch is in security mode.

Examples To reset the MAC-Forced Forwarding counters for ports 2, 3, 4, 5 and 8, use the command:

```
res macff count po=2-5,8
```

See Also
disable macff interface
enable macff interface
show macff
show macff interface counter

set macff server

Syntax

```
SET MACFF SERVer INTerface=vlan IPaddress=ipadd
   DESCription={desc}
```

Description

This command allows you to change the description of a statically configured AR or AS. You cannot modify the IP address or interface, as these two values are used as unique keys to permit device identification.

This command requires a user with security officer privilege when the switch is in security mode.

Parameter	Description
INTerface	The interface that the AR or AS is attached to. *vlan* is the name of a VLAN interface such as vlan46 or vlan122.
IPaddress	The IPv4 address of the AR or AS, in dotted decimal notation.
DESCription	An arbitrary description for the AR or AS. This can be between 0 to 255 characters long, and use any printable character. Leaving the option blank removes the current description without adding a new description.

Examples

To set the description of an AR with the IP address 192.168.5.2, which is attached to vlan5, to "Main LAN Gateway (Eva)", use the command:

```
set macff serv int=vlan5 ip=192.168.5.2 desc="Main LAN
   Gateway (Eva)"
```

To remove the description of an AS with the IP address 192.168.5.3, which is attached to vlan7, use the command:

```
set macff serv int=vlan7 ip=192.168.5.3 desc=
```

See Also

add macff server
delete macff server

show macff

Syntax `SHOW MACFF [COUnter]`

Description This command displays a summary of the VLANs with MAC-Forced Forwarding enabled on them, and MAC-Forced Forwarding status details (Figure 2, Figure 3, Table 1 on page 18). The **counter** parameter displays the combined counters for all VLANs, and counters for server activity on all VLANs.

Figure 2: Example output from the **show macff** command

```
MAC Forced Forwarding Information:
--------------------------------------------------------------------------------
VLAN Interface                  Dbg IP Address      State     Servers
--------------------------------------------------------------------------------
vlan2                           <*> 20.1.1.1        ENABLED         6
vlan3                               30.1.1.1        ENABLED         0
vlan6                               -               ENABLED         0

--------------------------------------------------------------------------------
```

Figure 3: Example output from the **show macff counter** command

```
MAC Forced Forwarding Information:
--------------------------------------------------------------------------------
VLAN Interface                  Dbg IP Address      State     Servers
--------------------------------------------------------------------------------
vlan2                           <*> 20.1.1.1        ENABLED         6
vlan3                               30.1.1.1        ENABLED         0
vlan6                               -               ENABLED         0


Overall Status:
  Number of Servers .......     6
  Servers Lost ............     0

ARP Counters( All Ports ):
ARP Counters:
  Requests ..................      2301    Replies ...................       0
  Resolution Request .......         48    Resolutions Failed .......      43
  Src : No DHCPSN ENTRY ....         42    Src : Inconsistent Data ..       0
  Src : No Routers .........          1    Src : No Routers Found ...       0
  Dest: No DHCPSN ENTRY ....          0    S/D : Same Port ..........       0

Server Counter:
  ARP Resolution Requests ..        345    ARP Resolutions ..........       0
  ARP Resolutions Failed ...        345    ARP Still Valid ..........       0
  Static Add ...............          0    Static Delete ............       0
  Dynamic Add ..............          0    Dynamic Delete ...........       0
  Dynamic Update Add .......          0    Dynamic Update Delete ....       0
  Dynamic Update: No New ...          0    Static Add Fail ..........       0
  Dynamic Add Fail .........          0    Static Delete Fail .......       0
  Dynamic Delete Fail ......          0

--------------------------------------------------------------------------------
```

Table 1: Parameters in the output of the **show macff [counter]** command

Parameter	Meaning
VLAN Interface	The VLAN for which MAC-Forced Forwarding information is displayed.
Dbg	Whether debugging is currently executing on the VLAN; "<*>" indicates yes, a blank space indicates no.
IP Address	Current IP address assigned to the specified VLAN.
State	Status of MAC-Forced Forwarding on the VLAN, either ENABLED or DISABLED.
Servers	Number of active ARs and ASs configured on the VLAN. This includes both statically defined and dynamically found devices.
Overall Status	
Number of Servers	Number of ARs and ASs currently in the DHCP snooping database.
Servers Lost	Number of ARs and ASs that have been deleted or lost, and have been removed from the DHCP snooping database.
ARP Counters (All Ports)	ARP counters for all VLANs with MAC-Forced Forwarding enabled.
Requests	Number of ARP Requests received by MAC-Forced Forwarding.
Replies	Number of ARP Replies that MAC-Forced Forwarding has sent on behalf of an AR or AS.
Resolution Requests	Number of ARP resolution Requests for an AR or AS that required MAC address resolution.
Resolutions Failed	Number of ARP Requests that failed to determine the MAC address of the AR or AS.
Src : No DHCPSN Entry	Number of ARP requests where the source client is not in the DHCP snooping database.
Src : Inconsistent Data	Number of ARP requests where the source client information in the DHCP snooping database does not match the source client information in the ARP request.
Src : No Routers	Number of ARP requests where the source client does not have a valid AR in the DHCP snooping database.
Src : No Routers Found	Number of ARP requests where MAC-Forced Forwarding could not contact any of the valid ARs for that client.
Dest : No DNCPSN Entry	Number of ARP requests between clients within a subnet where the destination client is not in the DHCP snooping database. The switch drops these requests.
S/D : Same Port	Number of ARP requests where the source and destination clients are on the same port (within a private network). The switch drops these requests.
Server Counter	
ARP Resolution Requests	Number of ARP resolution requests received for an AR or AS.
ARP Resolutions	Number of ARP resolution requests that MAC-Forced Forwarding successfully replied to.
ARP Resolutions Failed	Number of ARP resolution requests where MAC-Forced Forwarding was unable to reply with the MAC address of a valid AR or AS.

Table 1: Parameters in the output of the **show macff [counter]** command (cont.)

Parameter	Meaning
ARP Still Valid	Number of ARP resolution requests where the correct details for the AR or AS are already in the DHCP snooping database.
Static Add	Number of entries in the DHCP snooping database that were added using **add macff server**.
Static Delete	Number of entries in the DHCP snooping database that were removed using **delete macff server**.
Dynamic Add	Number of entries in the DHCP snooping database that DHCP snooping has dynamically added.
Dynamic Delete	Number of entries in the DHCP snooping database that DHCP snooping has dynamically deleted.
Dynamic Update Add	Number of entries in the DHCP snooping database that DHCP snooping added after its dynamic updating process.
Dynamic Update Delete	Number of entries in the DHCP snooping database that DHCP snooping deleted after its dynamic updating process.
Dynamic Update: No New	Number of times that all the valid servers associated with a client were removed from the DHCP snooping database after the DHCP snooping update process.
Static Add Fail	Number of times a static entry attempt failed to add an entry to the DHCP snooping database.
Dynamic Add Fail	Number of times DHCP snooping attempted and failed to add an entry to the DHCP snooping database.
Static Delete Fail	Number of times a static entry attempt failed to delete an entry from the DHCP snooping database.
Dynamic Delete Fail	Number of times DHCP snooping attempted and failed to delete an entry from the DHCP snooping database.

Example To display summary details for VLANs using MAC-Forced Forwarding, use the command:

```
show macff
```

See Also **show macff interface**
show macff interface counter

show macff database

Syntax `SHOW MACFF DATABase`

Description This command displays a detailed list of the ARs and ASs held in the DHCP snooping database (Figure 4, Table 2).

Figure 4: Example output from the **show macff database** command

```
Vlan ..................... vlan2
IP Address ............... 82.20.54.1
Description .............. DHCP Server (Nerv)
MAC Address .............. 00-00-04-01-16-13
Server type .............. Static, Dynamic(4)

Vlan ..................... vlan2
IP Address ............... 82.20.54.2
Description .............. Main LAN Gateway (EVA)
MAC Address .............. -
Server type .............. Static

Vlan ..................... vlan3
IP Address ............... 82.20.57.4
Description .............. -
MAC Address .............. 00-00-cd-23-b3-03
Server type .............. Dynamic(2)

Vlan ..................... vlan3
IP Address ............... 82.20.57.7
Description .............. -
MAC Address .............. -
Server type .............. Dynamic(4)

Vlan ..................... vlan3
IP Address ............... 82.20.57.12
Description .............. Second Unit (Asuka)
MAC Address .............. 00-22-53-20-ba-12
Server type .............. Static, Dynamic(2)
```

Table 2: Parameters in the output of the **show macff database** command

Parameter	Meaning
Vlan	VLAN interface that the AR or AS is attached to.
IP Address	IP address of the AR or AS.
Description	Description given to a statically defined AR or AS, as set with the **add macff server** and **set macff server** commands. A "-" is shown for dynamically defined entries, or static entries without a description.
MAC Address	MAC address of the AR or AS.
Server type	How the EAN knows of the AR or AS. • "Dynamic" means that DHCP snooping added the AR. The number in brackets is the number of DHCP snooping clients that can access this AR. • "Static" means the AR or AS was statically defined using the **add macff server** command. "Static" and "Dynamic" are both displayed when DHCP snooping has discovered an AR that is also statically defined. Dynamic AR entries remain in the database until there are no clients in the database that are allowed to access this AR.

Example To display the list of servers that the DHCP snooping database currently holds, use the command:

```
show macff datab
```

See Also
add macff server
delete macff server
set macff server
show macff interface
show macff interface counter

show macff interface

Syntax `SHOW MACFF INTerface=`*`vlan`*

Description This command displays the current status of MAC-Forced Forwarding on the specified VLAN (Figure 5, Table 3 on page 22). *vlan* is the name of a VLAN interface such as vlan46 or vlan122.

Figure 5: Example output from the **show macff interface** command

```
MAC Forced Forwarding Information:
--------------------------------------------------------------------------------
Interface ..............  vlan2
Status .................  ENABLED
IP address..............  20.1.1.1
Ports:
  Tagged ...............  None
  Untagged .............  2,22
Active servers .........  6
Debugging ..............  ALL - ARP, DHCP, PACKET, TRACE, SERVER, ERROR

Upstream Servers:

IP Address .............  82.20.54.1
Description ............  Default Gateway (Shojun)
MAC Address ............  00-00-04-01-16-13
Server type ............  Static

IP Address .............  82.20.57.4
Description ............  -
MAC Address ............  00-00-cd-23-b3-04
Server type ............  Dynamic(2)

--------------------------------------------------------------------------------
```

Table 3: Parameters in the output of the **show macff interface** command

Parameter	Meaning
Interface	VLAN interface that MAC-Forced Forwarding is configured on.
Status	Current state of MAC-Forced Forwarding on the VLAN, either ENABLED or DISABLED.
IP Address	IP address assigned to the VLAN.
Ports: Tagged	The tagged ports assigned to the VLAN; tagged ports transmit VLAN tagged frames.
Ports: Untagged	The untagged ports assigned to the VLAN; untagged ports transmit frames without VLAN tags.
Active Servers	Number of ARs and ASs in use by clients on this VLAN.
Debugging	Debugging modes that are enabled on the VLAN.
Upstream Servers	Lists the active ARs and ASs for this VLAN.
IP Address	IP address of the AR or AS attached to this VLAN.
Description	Description of the AR or AS, if it has been statically defined using the **add macff server** or **set macff server** commands.
MAC Address	MAC address of the AR or AS.

Table 3: Parameters in the output of the **show macff interface** command (cont.)

Parameter	Meaning
Server Type	How the EAN knows of the AR or AS. • "Dynamic" means that DHCP snooping added the AR. The number in brackets is the number of DHCP snooping clients that can access this AR. • "Static" means the AR or AS was statically defined using the **add macff server** command. "Static" and "Dynamic" are both displayed when DHCP snooping has discovered an AR that is also statically defined. Dynamic AR entries remain in the database until there are no clients in the database that are allowed to access this AR.

Example To see the current status of MAC-Forced Forwarding on vlan5, such as which debugging options are enabled, use the command:

```
show macff int=vlan5
```

See Also
add macff server
delete macff server
disable macff interface
enable macff interface
set macff server
show macff
show macff interface counter

show macff interface counter

Syntax `SHOW MACFF INTerface=`*`vlan`* `[POrt=`*`port-list`*`] COUNTer`

Description This command displays MAC-Forced Forwarding counters for each port on an VLAN (Figure 6, Table 4).

The **port** parameter allows you to select only a subset of ports to display information about. *port-list* is either a specific port, a range of ports using a hyphen to specify the range (n-m), or a comma-separated list of ports or port ranges. Port numbers start at 1 and end at m, where m is the highest numbered switch Ethernet port, including uplink ports.

Figure 6: Example output from the **show macff interface counter** command

```
MAC Forced Forwarding Information:
------------------------------------------------------------------------------
Interface ............... vlan2
Status .................. ENABLED
IP address............... 20.1.1.1
Ports:
  Tagged ................ None
  Untagged .............. 2,22
Active servers .......... 6
Debugging ............... NONE

Counters for Port: 2
ARP Counters:
  Requests .................      2301    Replies ..................       0
  Resolution Request .......        48    Resolutions Failed .......      43
  Src : No DHCPSN ENTRY ....        42    Scr : Inconsistent Data ..       0
  Src : No Routers .........         1    Scr : No Routers Found ...       0
  Dest: No DHCPSN ENTRY ....         0    S/D : Same Port ..........       0

Counters for Port: 22
ARP Counters:
  Requests .................         1    Replies ..................       0
  Resolution Request .......         8    Resolutions Failed .......       0
  Src : No DHCPSN ENTRY ....         2    Src : Inconsistent Data ..       0
  Src : No Routers .........         0    Src : No Routers Found ...       0
  Dest: No DHCPSN ENTRY ....         0    S/D : Same Port ..........       0

------------------------------------------------------------------------------
```

Table 4: Parameters in the output of the **show macff interface counter** command

Parameter	Meaning
Interface	VLAN that MAC-Forced Forwarding is configured on.
Status	Current state of MAC-Forced Forwarding on the VLAN, either ENABLED or DISABLED.
IP Address	IP address assigned to the VLAN.
Ports: Tagged	The tagged ports assigned to the VLAN; tagged ports transmit VLAN tagged frames.
Ports: Untagged	The untagged ports assigned to the VLAN; untagged ports transmit frames without VLAN tags.

Table 4: Parameters in the output of the **show macff interface counter** command (cont.)

Parameter	Meaning
Active Servers	Number of ARs and ASs in use by clients on this VLAN.
Debugging	Debugging modes that are enabled on the VLAN.
Counters for Port:	Specific port that the counters are for.
ARP Counters	
Requests	Number of ARP Requests received by MAC-Forced Forwarding from clients on this port.
Replies	Number of ARP Replies that MAC-Forced Forwarding has sent to clients on this port on behalf of an AR or AS.
Resolution Requests	Number of ARP Resolution Requests from clients on this port for an AR or AS that required MAC address resolution.
Resolutions Failed	Number of ARP Requests from clients on this port that failed to determine the MAC address of the AR or AS.
Src : No DHCPSN Entry	Number of ARP requests from clients on this port, where the source client is not in the DHCP snooping database.
Src : Inconsistent Data	Number of ARP requests from clients on this port where the source client information in the DHCP snooping database does not match the source client information in the ARP request.
Src : No Routers	Number of ARP requests from clients on this port where the source client does not have a valid AR in the DHCP snooping database.
Src : No Routers Found	Number of ARP requests from clients on this port where MAC-Forced Forwarding could not contact any of the valid ARs for that client.
Dest : No DNCPSN Entry	Number of ARP requests sent from clients on this port to another client within the same subnet, where the destination client is not in the DHCP snooping database. The switch drops these requests.
S/D : Same Port	Number of ARP requests from clients on this port where the source and destination clients are on the same port (within a private network). The switch drops these requests.

Example To see the counters for ports 2 to 10, 14 and 18, on vlan5 use the command:

```
show macff int=vlan5 po=2-10,14,18
```

See Also
disable macff interface
enable macff interface
reset macff counter
show macff
show macff interface